RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

Vol. 63 AUGUST, 1954 No. 2

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RADIOLOGY

A MONTHLY PUBLICATION DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

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Congenital Megacolon (Hirschsprung's Disease)[1]

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Philadelphia, Penna.

FOR THE PAST sixty years the term "Hirschsprung's disease" has been used to describe enlargement of the colon exclusive of megacolon due to demonstrable organic disease. In 1887, Hirschsprung published a paper entitled "Sluggishness of Stool in the Newborn Resulting from Dilatation and Hypertrophy of the Colon." In it he correlated the clinical and pathologic findings in 2 male infants who presented essentially the same clinical picture and course. Both had constipation and abdominal distention from birth and both died, at seven and eleven months of age, respectively. In the pathologic specimens of the colon in these 2 cases, hypertrophy of the bowel, inflammation, edema, and ulcerations of the mucosa were observed; only casual mention is made of the normal appearing rectosigmoid area. Hirschsprung concluded that the primary disease process involved the dilated portion of the colon, causing retention of gas and feces, and thought that the disease process was due to a congenital abnormality.

Various analogous cases had been reported prior to 1887, one by Fredricus Ruysch in the 17th century. Hirschsprung, however, was the first to establish the condition as a disease entity.

Although in the early reported cases of congenital megacolon the pathologic studies were concerned chiefly with the dilated colon, sporadic reports did appear in which attention was directed to a narrowed segment of colon distal to the dilated portion.

The first mention of abnormality in the distribution of ganglion cells in the bowel was made by Tittel in 1901. He described scanty ganglion cells of the myenteric plexus at various levels of the large intestine of a fifteen-month-old infant and noted that in the ileum the ganglion cells were normal. He thought that the abnormal state of the myenteric plexus might be a cause of abnormal peristalsis.

In 1920, Dalla Valle reported a case of megacolon in an infant of ten and a half months and in 1924 described a second case in a brother of the first patient. Many microscopic sections at various levels of the large bowel were examined from both children, special attention being paid to the ganglion cells of Auerbach's plexus. This was the first time that a comprehensive study of the ganglion cells of the myenteric plexus had been made. In both of these infants ganglion cells were absent in the normal appearing rectum and sigmoid but were present in the remainder

[1] From the Department of Radiology, St. Christopher's Hospital for Children and Temple University Hospital, Philadelphia, Penna. Abridgment of a thesis submitted to the Faculty of Temple University Hospital and Medical School in partial fulfillment of the requirements for Master of Science degree in Medicine. Accepted for publication in August 1953.

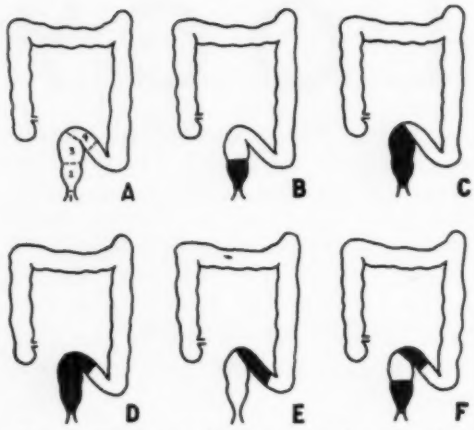


Fig. 1. Hirschsprung's disease: locations of various types of short aganglionic segments. A. Normal colon (1. Anal canal. 2. Lower rectum. 3. Upper rectum. 4. Rectosigmoid). B. Segment of aganglia in lower rectum. C. Segment of aganglia involving entire rectum. D. Segment of aganglia involving entire rectum and rectosigmoid. This is the most frequent type. E. Segment of aganglia in the sigmoid, with ganglia present above and below the involved segment (single zonal aganglia). F. Segments of aganglia in rectosigmoid and in the lower rectum (double zonal aganglia). Ganglia present in upper rectum and proximal to rectosigmoid.

of the colon, though in the first case they were few and small in the ascending portion.

In 1935, Perrot and Danon reported the case of a fifteen-day-old child in whom ganglion cells were scarce from the terminal ileum to the splenic flexure. It was their belief that hypoplasia of Auerbach's plexus had produced a functional obstruction.

Robertson and Kernohan, in 1938, found ganglion cells to be scanty or absent in a case of Hirschsprung's disease, but details as to where the deficiency occurred are not given.

A comprehensive study of a case of Hirschsprung's disease in a one-year-old infant was reported in 1940 by Tiffin *et al.* They noted the absence of ganglion cells for a distance of 5 to 7 cm. distal to the dilated bowel but found nerve fibers abundant in the region of Auerbach's plexus. Normal ganglion cells were present above and below the aganglionic segment.

In 1948, Zuelzer and Wilson described 11 cases of megacolon with aganglionic segments: 7 in the rectosigmoid area, 2 involving the entire colon, and 2 extending from the terminal ileum to the anus. The same year, Whitehouse and Kernohan reported the pathologic findings in a like number of cases of congenital megacolon. All of the specimens showed an absence of ganglion cells in a segment of bowel distal to the dilated portion.

In 1949, a major advancement in the diagnosis and treatment of Hirschsprung's disease was reported by Swenson and Neuhauser, who described a special method of barium enema examination of the colon for delineation of the narrowed segment and a method of surgical correction of the obstructing lesion. Since then, noteworthy contributions have been made by Bodian, Hiatt, and others.

CLASSIFICATION

Cases of megacolon may be divided into three main groups as follows: (1) organic megacolon; (2) idiopathic megacolon; (3) congenital megacolon (Hirschsprung's disease).

Organic megacolon may occur at any age. The obstructing lesion may be a tumor, stricture, congenital band, or other pathologic process which can be demonstrated grossly.

Idiopathic or functional megacolon has no definite etiologic basis. Contributing factors are: faulty bowel habits, spastic sphincter, and excessive water absorption from an unusually elongated sigmoid. Constipation is not present from birth. The onset of symptoms is slow and the mortality rate is low. The diagnosis is made by examination of the large bowel by a barium enema, which shows dilatation of the colon all the way to the anus.

Congenital megacolon, or Hirschsprung's disease, is due to the absence of ganglion cells or diminished ganglion cells in the myenteric plexus of the narrowed segment. Constipation is present from birth. The rectum may or may not appear normal on sigmoidoscopic examination or feel normal on digital examination, depending on

the site of the lesion. Usually, with the typical rectosigmoid lesion, the rectum is empty. The diagnosis is made by demonstrating the narrowed segment of bowel by means of a barium enema examination of the colon.

Megacolon, idiopathic megacolon, and Hirschsprung's disease have been used synonymously. The term Hirschsprung's disease should, however, be reserved for those cases in which there is a functional obstruction of the bowel as a result of a narrowed segment due to an absence (or diminution) of ganglion cells in the myenteric plexus. The diminished caliber of the affected segment can be demonstrated roentgenographically.

The narrowed segment of bowel in Hirschsprung's disease may be short or long. Approximately 90 per cent of the cases will show short segments and 10 per cent long segments. Figures 1 and 2 show the sites of the various types of aganglionic segments that may be encountered. The typical and most common form occurs in the rectosigmoid area. The narrowed or spastic segment of bowel usually represents only a part of the aganglionic area, since a normal appearing rectum, also devoid of ganglion cells, may be demonstrated by barium enema examination. Some cases show narrowing of the entire rectum and rectosigmoid area, corresponding to the entire extent of aganglionic bowel. Disturbing cases are occasionally encountered with classical clinical and radiographic evidence of the disease in which the narrowed segment shows the presence of ganglion cells, though these are apparently diminished in number.

A few cases of single zonal aganglia have been reported (*i.e.*, the presence of ganglion cells proximal and distal to the narrowed segment) by Perrot and Danon (1935), Tiffin *et al.* (1940), Swenson *et al.* (1949), and Hiatt (1951). In the series of 18 cases upon which this paper is based, we have encountered a case of double zonal aganglia (Case XI, Fig. 15), in which two aganglionic zones were present, one in the rectosigmoid area and the other in the lower rectum, separated by a grossly normal upper rectum containing ganglion cells.

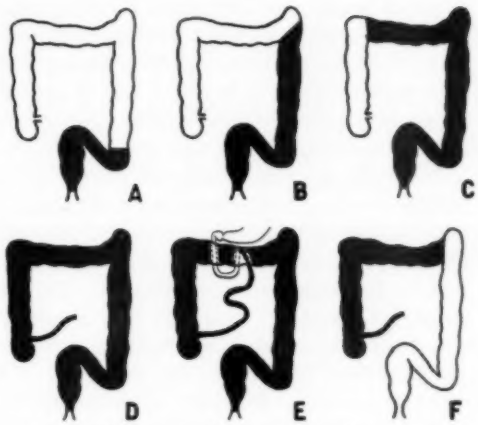


Fig. 2. Hirschsprung's disease: locations of various types of long aganglionic segments. A. Segment of aganglia extending from distal descending colon to anus. B. Segment of aganglia from splenic flexure to anus. C. Segment of aganglia from hepatic flexure to anus. D–F. Variants of Hirschsprung's disease, with absence of megacolon. D. Segment of aganglia from distal ileum to anus. E. Segment of aganglia from duodenojejunal junction to anus. F. Segment of aganglia from distal ileum to splenic flexure. Ganglia present proximal to involved distal ileum and distal to splenic flexure.

Not infrequently, one finds the aganglionic segment *and* the narrowed area in the upper or lower rectum. Aganglionic areas in the lower rectum that have been present for some time may not show the narrowed segment, since persistent increased intraluminal pressure may cause this area to dilate down to the anus. The diagnosis in this type of case is difficult, if not impossible, but fortunately the constipation may be controlled by conservative measures. Undoubtedly the true nature of some of these cases is not recognized, and they are labeled as idiopathic megacolon.

In the long-segment variety, the aganglionic segment most commonly extends from the splenic flexure to the anus. This type can be easily missed if one does not consider the possibility of a long aganglionic segment or if the barium enema study is limited to the rectum or to the rectosigmoid area. During the barium enema examination, the rectum, recto-

sigmoid area, and descending colon may appear normal in caliber, so that, until the transitional zone between the dilated and narrowed segment is reached, the diagnosis is not apparent and the findings are therefore interpreted as normal.

In 1951, Bodian reviewed all the published cases of Hirschsprung's disease in which observations were made on the abnormal segment of bowel and some indication was given as to its length. Of 160 cases reviewed, 13 were of the long-segment variety, including 9 with involvement extending from the anus to the splenic flexure, 1 from the anus to the hepatic flexure, 1 from the anus to the ileocecal valve, and 2 from the anus to the distal ileum. Bodian included a case of his own in a four-day-old boy who was explored because of intestinal obstruction. At surgery, distended loops of small bowel were found and the entire colon was grossly normal in appearance, containing a small quantity of meconium. A catheter was passed per rectum into the descending colon. Since no mechanical obstruction could be found, further interference seemed unwarranted and the abdomen was closed. Abdominal distention increased, however, and no meconium was passed. In view of the child's poor condition, only a transverse colostomy was established. Death occurred at the age of ten days without meconium having been passed. Necropsy revealed absence of ganglion cells from the duodenojejunal junction to the anus.

In order to prevent confusion in terminology and to retain the synonymous relationship of megacolon to Hirschsprung's disease, other cases of aganglionic bowel of the long-segment variety in which the absence of ganglion cells extends beyond the colon into the small bowel should be regarded as variants of the disease, related as to etiology, but different in that dilatation of the colon is absent. It must be remembered that dilatation of the colon may not be present during the first few days of life and that an aganglionic segment which involves the entire colon and extends into the small bowel may show a microcolon rather than a megacolon.

SIGNS AND SYMPTOMS

Classically, symptoms of congenital megacolon begin at birth or during the first few weeks of life, with constipation, progressive abdominal distention, and vomiting. In newborn infants, vomiting is usually the first symptom, followed by delay in the passage of meconium stools. Abdominal distention may gradually appear, relieved at first by enemas, but later becoming persistent and extreme. Some of these young patients present signs of acute intestinal obstruction. Unless this is relieved by surgical intervention, they become steadily worse and usually die at an early age. At the time of surgery, one finds an area of spasm or narrowing, usually in the sigmoid area, which has produced a functional type of obstruction.

Occasionally diarrhea associated with vomiting may be the initial symptom and in such cases diagnosis may be difficult. The clinical picture may simulate intestinal allergy, peritonitis, cystic fibrosis of the pancreas, or disease of the central nervous system.

Some infants show less well defined clinical symptoms. Intermittent constipation and abdominal distention may be controlled initially by conservative management. The constipation, however, gradually becomes more marked, despite the usual measures. The advanced case of Hirschsprung's disease shows abdominal enlargement due to the distended and dilated colon; fecal masses may be palpated through the abdominal wall, and rectal examination usually reveals a rectum free of fecal material. The patient appears malnourished, and a hypochromic anemia is often a complicating factor.

Not infrequently the presenting signs and symptoms are those of shock following the administration of tap-water enemas. A number of deaths have been reported incident to this procedure, and one death has been recorded following a barium-enema examination. The picture of shock

is explained by the rapid diffusion of water into the circulation through the large absorptive surface of the dilated bowel. Hiatt showed the rate of absorption of water from the colon to be dependent on the intraluminal pressure; the symptoms of shock may therefore be precipitated by straining and are accompanied by a sudden and marked drop in the sodium and chloride concentrations of the plasma.

In our series of 18 cases of Hirschsprung's disease, forming the basis of this study, the presenting signs and symptoms were as indicated in Table I. Eight patients had chronic constipation, gradually becoming more marked despite cathartics and enemas. Five patients had signs and symptoms of acute intestinal obstruction. Two of these patients (Cases I and XI) were admitted to the hospital with acute obstruction and in a state of shock following tap-water enemas. The first patient (Case I) made an uneventful recovery following resection of an aganglionic segment in the distal colon. The second (Case XI) died before therapy could be instituted. He had been treated conservatively with enemas from birth until his death at three months of age.

TABLE I: PRESENTING SIGNS AND SYMPTOMS IN 18 CASES OF HIRSCHSPRUNG'S DISEASE

A.	Chronic constipation (8 cases) Ages: 2, 3, 4, 4, 6, 7, 7 and 8 years.
B.	Intestinal obstruction (5 cases) Ages: 3 days, 10 days, 6 weeks, 5 months, 7 years.
C.	Vomiting, diarrhea, abdominal distention (3 cases) Ages: 2, 5, 7 weeks.
D.	Alternating constipation and diarrhea (2 cases) Ages: 1, 2 months.

Three patients had a history of vomiting, diarrhea, and abdominal distention since birth. The symptoms were most severe in this group. One of these patients (Case XIII) died at seven weeks of age. At necropsy an aganglionic segment extending from the sigmoid to the anus and ulceration of the mucosa of the colon were found.

The paradoxical diarrhea that occurs in infants with Hirschsprung's disease is thought to be due to irritation of the bowel wall as a result of fecal stasis. Two patients of this series had alternating constipation and diarrhea from birth.

PATHOGENESIS

Much investigative work has been done to determine the pathologic physiology in Hirschsprung's disease, and several theories have been formulated to explain the abnormal function of the large bowel. As early as 1901, Tittel felt that some correlation existed between the scarcity of ganglion cells in the myenteric plexus of the colon and the normal progression of peristalsis. Essentially the same conclusions were reached by Tiffin *et al.* in 1940. These authors postulated that the primary disturbance was an interference with the passage of peristaltic waves across an aganglionic segment, due to defective innervation. The sequence of alternate relaxation and contraction composing the peristaltic wave was prevented, thus resulting in the ineffectual propulsion of colonic contents across the involved segment.

Swenson and his associates and Hiatt obtained kymographic tracings of the motility of the colon with the use of balloons inserted into the rectum, sigmoid, and descending colon. By this multiple-balloon technic they showed that the aganglionic segment failed to exhibit coordinated peristaltic activity and constituted a chronic obstruction to the passage of feces. Normal peristaltic waves progressed down the colon to the aganglionic segment, at which point the orderly relaxation-contraction cycle was replaced by a non-propulsive mass contraction, still coordinated with peristaltic waves from above. From these observations it became apparent that dilatation and hypertrophy of the bowel were secondary compensatory mechanisms occurring proximal to the abnormal segment.

The disturbance in normal defecation associated with Hirschsprung's disease is due not only to obstruction by the narrowed segment but also to loss of the normal defecation reflex. Kuntz wrote: "Under

certain conditions defecation may be carried out as a pure reflex. The defecation reflex involves peristaltic contractions of the rectum or the entire colon, together with inhibition of the anal sphincters. This reflex normally is excited by the entrance of feces into the rectum (Cannon). *Rapidly increasing tension* of the rectal musculature causes tonic contractions to give way to phasic contractions. If delivery of fecal material from the colon is adequate, the mechanism of defecation depends primarily on the reaction of the rectum to distention."

In Hirschsprung's disease, therefore, in addition to the narrowed obstructing segment, there is inadequate delivery of feces to the aganglionic rectum, which in turn lacks the normal defecation reflex. Feces pass into the aganglionic segment merely by the propulsive action of the hypertrophied bowel, moving the fecal column into and beyond the area of narrowing. Once the feces have passed into the aganglionic segment, the absence of the defecation reflex and the un-co-ordinated rectal contractions prevent normal evacuation. It is through further vigorous contractions of the hypertrophied bowel, along with the voluntary relaxation of the external sphincter, that feces are expelled. Therefore, if compensatory dilatation and hypertrophy cannot overcome the obstruction, further evacuation is impossible, and other measures for emptying the colon must be used. In summary, then, we are dealing with a physiologically abnormal segment of colon, preventing adequate delivery of feces into a rectum which already lacks propulsive activity.

Results of experiments seem to indicate that the rhythmic contractions of the colon can be carried out in the absence of the extrinsic nerve supply. Under these circumstances, the rhythmic contractions of the colon must be mediated through the intrinsic neural mechanisms. It seems logical, therefore, to exclude the extrinsic nerve supply as playing a significant role in dysfunction of the involved segment. In the absence of ganglion cells, with the extrinsic nerve supply intact, mass contraction is possible but co-ordinated propulsive movements are lacking.

It is not clearly understood why the absence of ganglion cells is most prevalent in the rectosigmoid area in Hirschsprung's disease. Since the origin of visceral ganglion cells is still somewhat vague, the site and extent of involvement in aganglionic segments cannot be adequately explained. Yntema and Hammond summarize the development of the ganglia in the bowel as follows: "Enteric and other visceral ganglia may arise from one or more rudiments. Recent reports indicate as sources: (1) neural crest of the trunk, (2) neural crest or tube from levels of the parasympathetic nuclei in the brain stem and sacral level of the spinal cord. In addition, local differentiation from mesoderm and endoderm has been reported. A formative action of preganglionic fibers upon differentiation of autonomic ganglia has been suggested."

Swenson considered Hirschsprung's disease to be a failure of development of the myenteric plexuses in the rectum and rectosigmoid due to developmental arrest of the pelvic parasympathetic nerve supply. This theory would not explain the occurrence of long aganglionic segments. Bodian suggested that the primary disturbance of Hirschsprung's disease is an agenesis of the ganglion cells which form Auerbach's and Meissner's plexuses and that this change is not conditioned by a failure of development of the extrinsic nerve supply of the intestine. He stated that embryologic development generally begins at the cranial extremity and progresses caudally. If this applies to the intramural ganglion cells, a genetically determined disturbance of development with variable time of onset would explain long, intermediate, and short aganglionic segments extending to the anus, which is the typical finding in Hirschsprung's disease. Ganglion cells in the transitional zone would be imperfect, since they would be in the process of formation at the time

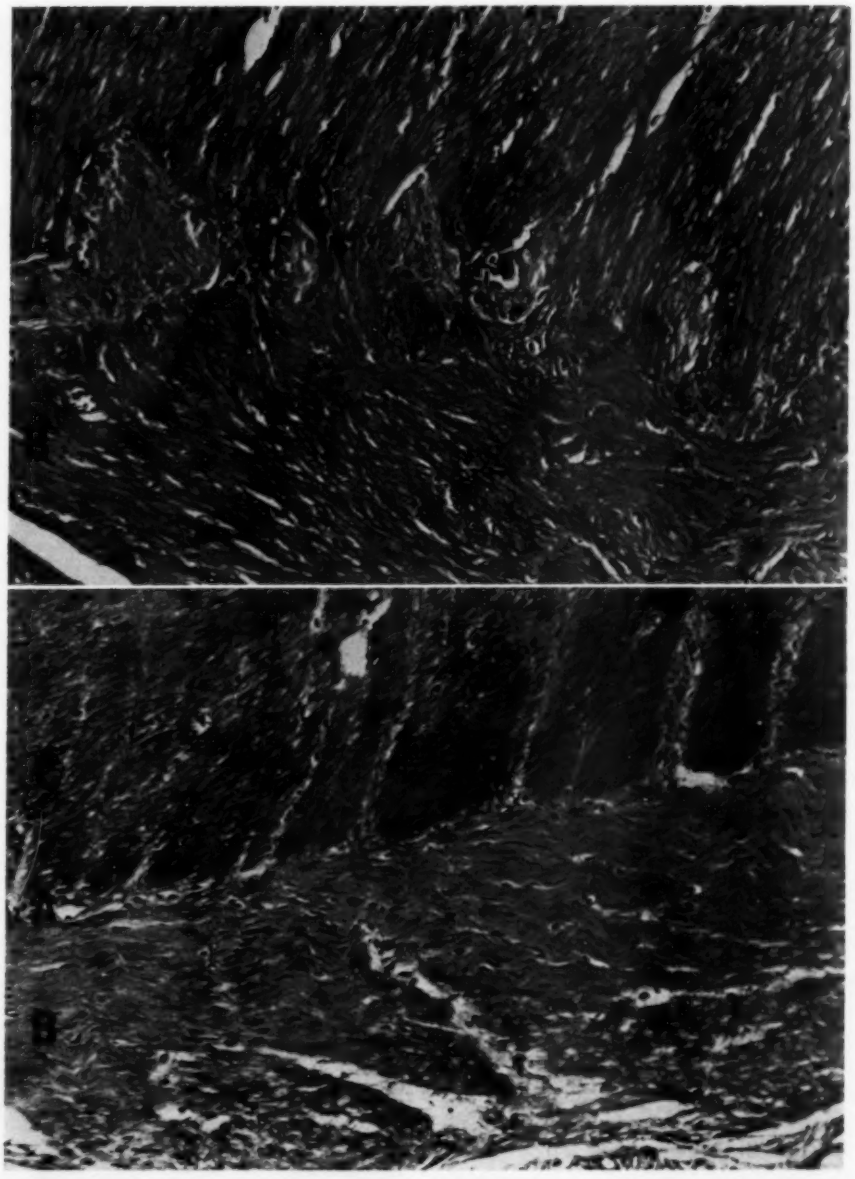


Fig. 3 (above). Photomicrograph of section from dilated colon, Case XVIII. A. Normal intramural plexuses with normal ganglion cells. B. Longitudinal muscle. C. Circular muscle. × *c.* 150.

Fig. 4 (below). Photomicrograph of section from narrowed, spastic segment of colon in same case, showing absence of the intramural plexuses. Compare with normal myenteric plexuses seen in Fig. 3. A. Usual site of myenteric plexus. B. Longitudinal muscle. C. Circular muscle. × *c.* 150.

of onset of the disturbance. The large non-myelinated nerve trunks between the longitudinal and circular muscle layers in the involved segment of bowel Bodian identifies as preganglionic parasympathetic fibers which, failing to terminate at

Fig. 5. Case I. F. G. Roentgenogram with barium in the distal colon, showing a narrowed segment in the rectosigmoid area with a relatively normal appearing rectum. Note the dilatation of the colon proximal to the narrowed segment. The tracing of the roentgenogram in the insert shows the extent of aganglia in white.

ganglion cells, grow caudally between the muscle layers and submucosa for a considerable distance. Agenesis of the intramural ganglion cells would thus be the primary disturbance, and development of large nerve trunks, apparently normal preganglionic parasympathetic fibers, a secondary phenomenon.

In order to explain the rare cases of single zonal aganglia, Bodian postulated that sometimes, in addition to the craniocaudal differentiation of intramural intestinal ganglia, there is a caudocranial differentiation. A disturbance some time before the completion of this dual differentiation would explain zonal agenesis with normal ganglia both above and below. This theory, however, does not explain the double zonal aganglia observed in Case XI of this series. Histologic studies of the colon of this patient showed complete absence of ganglion cells in the rectosigmoid area and the lower rectum; normal ganglion cells were present in the upper rectum.

One could explain the various types of aganglionic segments by a disturbance in the embryologic development of the intramural ganglion cells in a craniocaudal direction. Cessation of development of the ganglion cells before innervation is com-

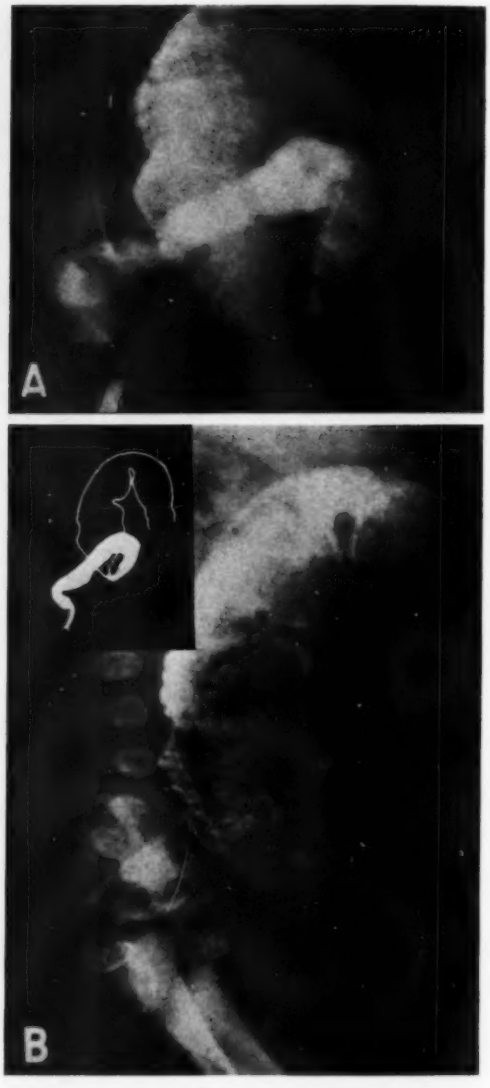
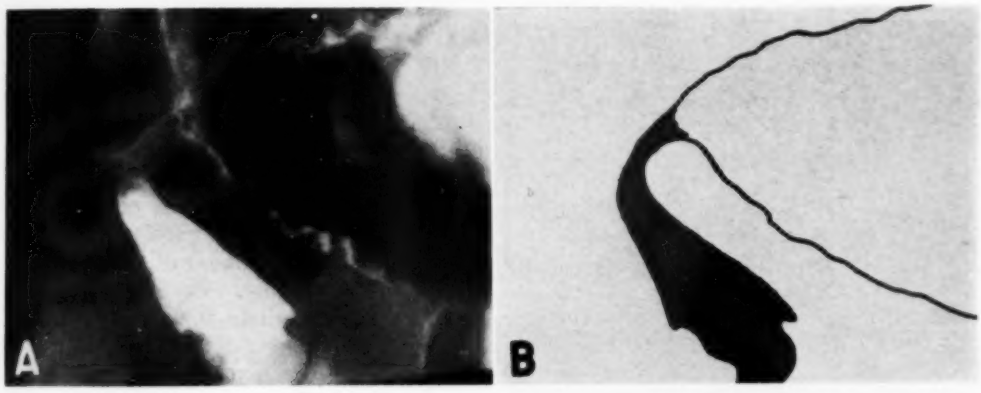


Fig. 6. Case II. M. W. A. Barium-contrast roentgenogram showing a narrowed segment which extends from the proximal sigmoid colon to the anus. Note the funnel-shaped transitional zone and the dilatation of the colon proximal to the narrowed segment. B. Double-contrast roentgenogram showing the narrowed segment in the lateral view. In the insert the aganglionic segment is shown in white.

Fig. 7. Case III. A. H. A. Barium-contrast film showing the spastic segment extending from the rectosigmoid area to the anus. Note the extreme dilatation of the colon proximal to the rectosigmoid area. B. Tracing of A, with the corresponding aganglionic segment in black.



plete would explain short, long, and intermediate aganglionic segments extending to the anus. A temporary cessation of development before final differentiation has occurred could explain both single and double zonal aganglia.

INCIDENCE

The exact incidence of Hirschsprung's disease is not known. Over an eighteen-year period (1886–1904), Hirschsprung collected 10 cases, 9 of which were in males. Approximately 80 per cent of the recorded cases have been in males. Reports on the incidence vary from 1:1,000 to 1:20,000 live births. The apparent increase in incidence in the past few years is undoubtedly directly related to better diagnostic acumen, both on the part of the clinician and the radiologist.

Fig. 8. Case IV. D. N. A. Double-contrast roentgenogram demonstrating the area of narrowing distal to the funnel-shaped dilated bowel. B. Tracing of A, with the aganglionic segment in black. C. Roentgenogram of barium-filled distal colon six months after a Swenson pull-through procedure. Note the normal caliber of the colon.

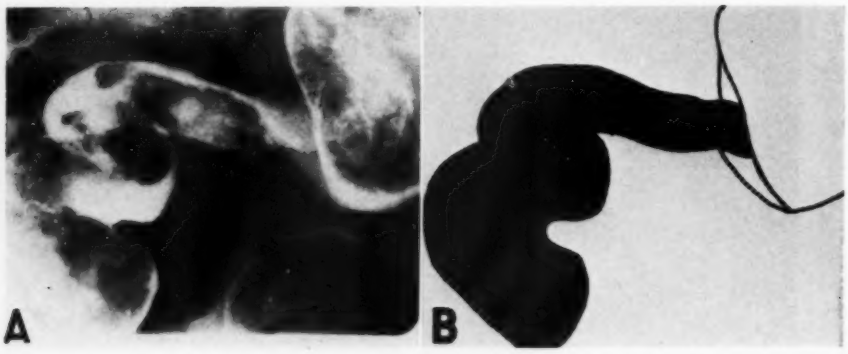


Fig. 9. Case V. L. D. A. Double-contrast roentgenogram showing the narrowed segment in the sigmoid colon with a normal appearing rectum. Note the abrupt transition between the narrowed and dilated segments. B. Tracing of A indicating the extent of aganglia in black. The normal appearing rectum also lacks ganglion cells.

Fig. 10. Case VI. R. H. A. Barium-contrast roentgenogram showing the zone of narrowing in the lower rectum and the dilatation of the rectum above this point. B. Double-contrast film with better visualization of the transitional zone. Note the sharp cut-off representing the proximal end of the spastic area.

Familial cases have been reported: by Dalla Valle in two brothers; by Zuelzer and Wilson in five siblings of a family of twelve; by Buttersack in a father, son, niece, and nephew; by Popper in female twins. Of 40 cases reviewed by Bodian, 7 were in three families. In one member from each family the diagnosis was proved, while the siblings had radiographic evidence of the disease. Bodian shows that the chance of a male sibling of a patient with Hirschsprung's disease being affected is about one in five, whereas that of a female sibling being affected is very small.

ROENTGEN FINDINGS

The roentgenographic diagnosis of Hirschsprung's disease is made by demonstrating a narrowed segment of colon, usually in the rectosigmoid area, and proximal to this narrowed segment, or so-called "spastic" area, a striking dilatation. For delineation of the involved segment we have used the technic which was first described by Neuhauser. This consists in inserting a small caliber catheter just beyond the anal sphincter. The patient is placed in the left lateral decubitus position and barium is slowly introduced under fluoroscopic guidance for examination of the rectum. The patient is then turned into various positions for the best visualization of the sigmoid colon as it slowly

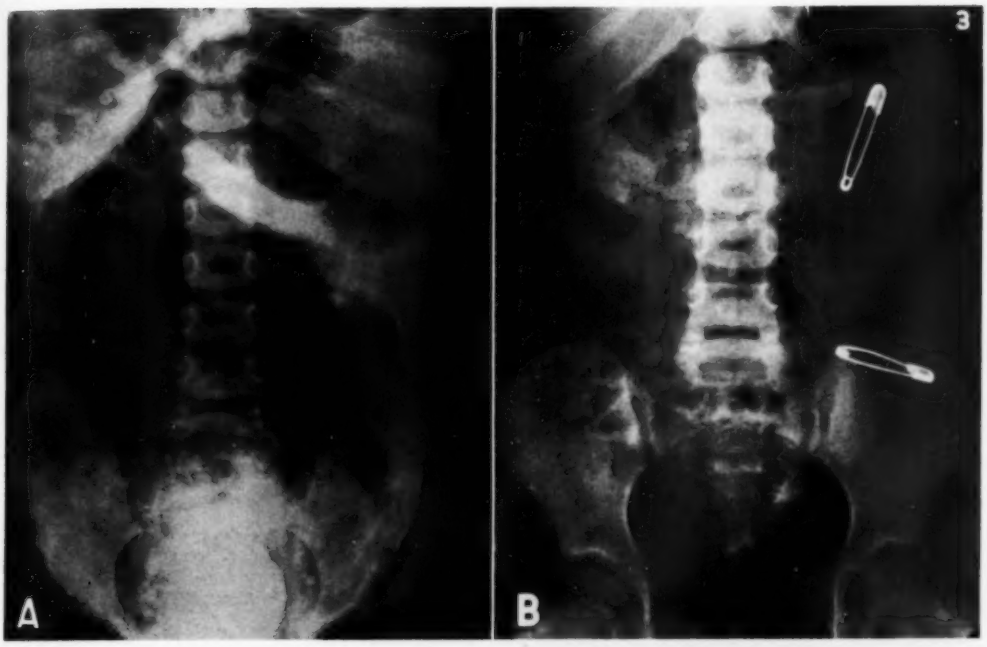


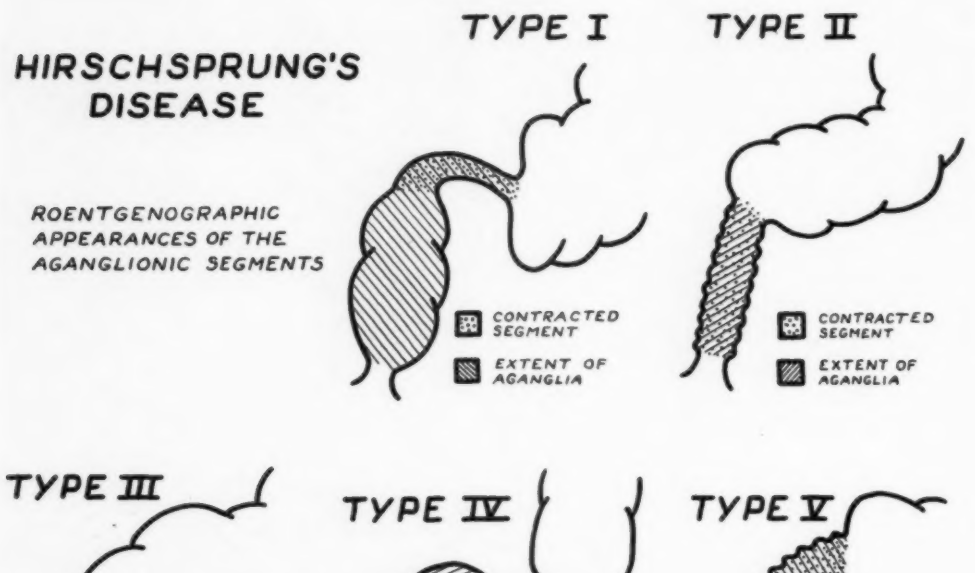
Fig. 11. Case VII. B. J. W. A. Roentgenogram of the abdomen showing extreme dilatation of the distal colon. B. Roentgenogram of the abdomen taken nine months following a Swenson pull-through procedure. Note the change to a relatively normal appearing abdomen. C. Barium-contrast-film showing the area of narrowing in the rectosigmoid region which is overlapped by the proximal dilated colon. Note relatively normal appearing lower rectum. The tracing of the film shows the corresponding aganglionic segment represented by the white and striped areas.

fills with barium. Spot films are taken during the filling of the rectum and sigmoid. If the barium is permitted to flow too rapidly, the narrowed segment may be missed.

If a narrowed segment is observed by the above method, the flow of barium is allowed to enter the dilated bowel for only a short distance, sufficient to demonstrate the extent of the transitional zone, *i.e.*, change from small to large caliber. It is not recommended that complete filling of the colon be carried out when a lesion is demonstrated, as barium impaction or water intoxication may result. Normal saline should be used in preparing the barium suspension mixture to avoid the possibility of the latter complication.

In the absence of a spastic segment in the rectosigmoid area, the remainder of the colon is examined in the same manner, so as to exclude the possibility of a long aganglionic segment. In our series of 18

TABLE II



patients, 2 showed long aganglionic segments, one extending from the anus to the hepatic flexure and the other extending from the anus to the splenic flexure.

Post-evacuation films made with the patient in the left lateral decubitus or left posterior oblique position often are of value in further demonstrating the narrowed or spastic segment, as well as in revealing stasis or retention of barium in the colon proximal to the involved segment.

We have found a double-contrast study of definite diagnostic value in demonstrating a narrowed segment in some cases in which the area of involvement was not seen or the findings were inconclusive after the introduction of barium by the aforementioned method. It is frequently difficult to obtain an ideal double-contrast study because of poor evacuation of the barium mixture. However, the retained barium and feces in the air-filled colon do not interfere with interpretation of the caliber of the colon. The value of this procedure is illustrated by Figures 6, 10, 12, and 14. In Case VIII (Fig. 12) the involved segment was not demonstrated on the film made with the rectum filled with barium but was visualized by the double-contrast study. An additional advantage may be obtained from the use of injected air into the colon in these cases, since the transitional zone may be more clearly seen than with complete filling of the colon, when overlapping of barium-filled bowel may obscure the picture. The gross appearance of the transi-

tional zone does not necessarily demarcate the zone of change from ganglionic to aganglionic bowel, since some dilatation of the proximal end of the aganglionic segment may occur in the cases of long duration. Constant increased intraluminal pressure accounts for this finding.

The fluoroscopic and roentgenographic appearances of the aganglionic segments may show one of the following variations:

Type I. The proximal part of the aganglionic segment may be contracted, whereas the distal part may be relatively normal in size (Figs. 5, 9, 11C).

Type II. The entire aganglionic segment may be markedly contracted (Figs. 6 and 7).

Type III. A relatively short segment of annular spasm may represent the proximal part of the aganglionic segment (Figs. 10, 12A, 13, 14).

Type IV. The aganglionic segment may seem to be normal but in comparison with the dilated bowel above shows a marked difference in caliber (Fig. 16).

Type V. Two areas of spasm separated by a normal segment of bowel (Fig. 15).

These variations are illustrated diagrammatically in Table II.

Ganglion cells are absent throughout the entire segment down to the anus, irrespective of the type of narrowing present. In a few rare cases normal ganglion cells have been found distal to the narrowed segment (single zonal aganglia). We have not encountered a distribution of this type in our series of cases. However, should the single zone of aganglia occur in the rectosigmoid region, the roentgenographic appearance would be similar to the Type I deformity shown in Table II. As previously stated, we encountered a case of "double zonal aganglia" (Case XI, Fig. 15) in which ganglion cells were present in a segment of bowel between two zones of aganglionic colon. The ganglionic segment was of normal caliber.

The length of the narrowed segment occurring in either the rectum, rectosigmoid area, or sigmoid varies from 2 to 25 cm. The low rectal segments are the shortest, measuring only a few centimeters, whereas the sigmoid segments may be as long as 25 cm. In the majority of cases, the transition between the narrowed and dilated segments is abrupt. Occasionally the transition is more gradual, so that the transitional zone is funnel-shaped in appearance,

Fig. 12. Case VIII. A. T. A. Double-contrast film showing an area of spasm in the lower rectum. The tracing in the insert shows the corresponding aganglionic segment in white. B. Roentgenogram of the barium-filled rectum does not show the area of spasm seen in A.

TABLE III: CORRELATION OF ROENTGENOGRAPHIC AND PATHOLOGIC FINDINGS IN 18 CASES

Case	Age and Sex	Roentgenographic Findings	Pathologic Findings
I. FG	7 yr. M	Rectosigmoid narrowing	Resection; aganglia from rectosigmoid to anus
II. MW	2 wk. M	Narrowing from proximal sigmoid to anus	Narrowing proved at surgery; colostomy performed
III. AH	2 mo. M	Narrowing from rectosigmoid to anus	Narrowing proved at surgery; colostomy performed
IV. DN	4 yr. M	Narrowing of upper rectum	Resection; aganglia from upper rectum to anus
V. LD	4 yr. M	Sigmoid narrowing; rectum normal in appearance	Resection; aganglia from proximal sigmoid to anus
VI. RH	7 yr. M	Narrowing in lower rectum	Resection; specimen lost
VII. BW	6 yr. F	Rectosigmoid narrowing	Resection; aganglia from rectosigmoid to anus
VIII. AT	3 yr. M	Narrowing in lower rectum	Resection; aganglia from lower rectum to anus
IX. EG	8 yr. M	Narrowing in lower rectum	Resection; narrowing proved at surgery; ganglia present without obvious abnormality
X. FS	7 yr. F	Narrowing in lower rectum	Narrowing proved at surgery; resection; ganglia present without obvious abnormality
XI. RT	10 days M	Narrowing of sigmoid and lower rectum with normal appearing upper rectum	Autopsy; aganglia in sigmoid and lower rectum; normal ganglia in upper rectum
XII. TB	1 mo. M	Change in caliber at splenic flexure	Autopsy; ganglia from splenic flexure to anus
XIII. DM	5 wk. F	No barium enema for localization of lesion	Autopsy; aganglia from rectosigmoid to anus
XIV. RD	5 mo. M	Rectosigmoid narrowing	Resection; aganglia from rectosigmoid to anus
XV. KG	3 days F	No barium enema prior to surgery	Dilatation of proximal large bowel proved at surgery; cecostomy performed; biopsies showed aganglia from hepatic flexure distally
XVI. JH	2 yr. M	Rectosigmoid narrowing	Resection; aganglia from rectosigmoid to anus
XVII. JR	7 wk. M	Rectosigmoid narrowing	Narrowing proved at surgery; colostomy performed
XVIII. DF	6 wk. M	Rectosigmoid narrowing	Sigmoidostomy; resection 3 years later; aganglia from rectosigmoid to anus

the mouth of the funnel being represented by the dilated segment.

All the various types of deformities illustrated in Table II have been encountered in patients with short aganglionic segments. In our experience, the long aganglionic segments show deformities of either Type II or Type IV. If the entire colon is aganglionic, megacolon is usually absent. Instead, the entire colon is somewhat smaller in caliber than normal or is markedly contracted.

PROGNOSIS AND TREATMENT

Recent reports indicate that approximately 10 per cent of the deaths in Hirschsprung's disease occur during the neonatal period. Most of these cases were found to have the long-segment variety of aganglionic megacolon. The disease may, however, be just as fulminating and rapidly fatal in cases with short aganglionic segments, so that the length of involvement does not necessarily determine the prognosis. If the patient survives the first few years of life, the prognosis is better, provided that conservative treatment is adequate in controlling the symptoms of chronic constipation. Deaths occurring in childhood may be due to either intestinal obstruction or to electrolyte imbalance. Some fatalities have occurred from shock and water intoxication following enemas.

Since accurate differential diagnosis of megacolon has been available only for the past four years, it is difficult to determine how many patients with true Hirschsprung's disease survive through adult life. A few cases of aganglionic megacolon have been reported in the older age group. Rosin

reported the case of a 54-year-old physician who had a history of chronic constipation since birth but who was otherwise normal. The narrowed segment of colon was demonstrated in the rectosigmoid area by barium enema examination. Histologic studies of the resected narrowed segment showed absence of ganglion cells. Although this case is unusual because of the age of the patient, it proves that adequate medical management may provide good general health with an active and productive life. Undoubtedly, some cases which have been classed as idiopathic megacolon, and eventually come to surgery, will be found actually to be aganglionic megacolon. Some of these cases will never be proved, especially those with low rectal

Fig. 13. Case IX. E. G. Barium contrast film demonstrating an annular, spastic segment in the lower rectum. The colon proximal to the spastic segment is dilated with feces.

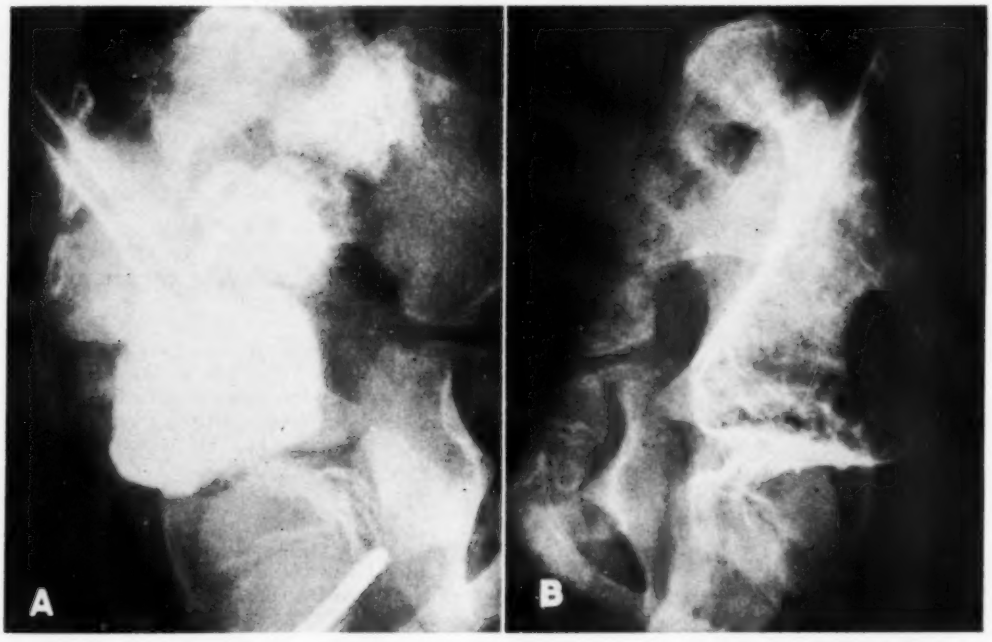


Fig. 14. Case X. F. S. A. Roentgenogram with barium in the rectum. Note the site of narrowing in the lower rectum. B. Double-contrast roentgenogram with better demonstration of the spastic segment.

aganglionic segments. These patients have learned to live with their constipation and have been able to control it by conservative measures.

The accepted method of treatment of Hirschsprung's disease at the present time is the removal of the obstructing aganglionic segment of bowel. Swenson's operative pull-through technic consists of the removal of the abnormal segment and restoration of the continuity of the bowel with preservation of the anal sphincters. This may be accomplished by a one- or two-stage procedure. The two-stage pro-

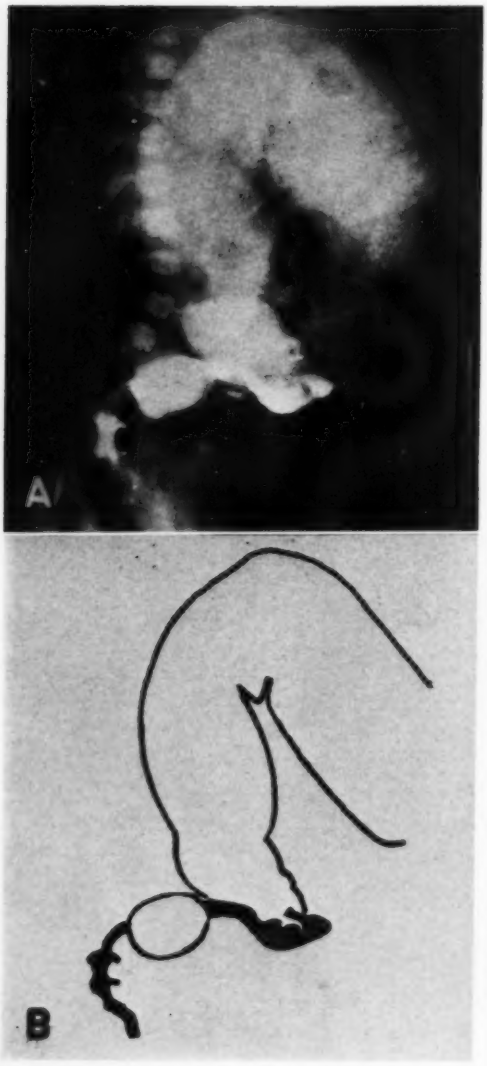


Fig. 15. Case XI. R. T. A. Barium-enema roentgenogram showing two areas of narrowing, one in the sigmoid colon and one in the lower rectum. Note the dilatation of the colon proximal to the sigmoid narrowing. The upper rectum appears normal in caliber. B. Tracing of A, showing the two zones of aganglia in black, separated by a normal upper rectum with normal myenteric plexuses (double zonal aganglia).

cedure consists of a colostomy followed by resection of the narrowed segment at a later date. In resecting the aganglionic segment, enough dilated bowel must be removed to be definitely above the obstructing aganglionic segment. This prevents anastomosing aganglionic bowel to the para-anal segment. In patients with a long aganglionic segment, extending from the anus to the terminal ileum, an enterostomy must be established proximal to the aganglionic segment.

SUMMARY AND CONCLUSIONS

1. The literature on congenital megacolon has been reviewed.
2. The classification of megacolon has been outlined and the differential diagnosis discussed.
3. The embryologic development of the myenteric plexus and the pathologic physiology of Hirschsprung's disease have been considered and discussed. An additional explanation for the pathologic development and prevalent sites of aganglionic segments has been presented.
4. The variations in the roentgenographic findings in Hirschsprung's disease have been described. Roentgenograms show the various types of abnormal segments encountered in a series of 18 cases. The roentgenographic and pathologic findings have been correlated.
5. An unusual case of "double zonal aganglia" (Case XI) was encountered in this series of cases.

NOTE: We wish to express our appreciation to Dr. James B. Arey for his valuable assistance in reviewing and discussing pathological findings in these cases and to Dr. Samuel L. Cresson for the use of the clinical records and surgical observations in most of these patients.

ADDENDUM

Since the submission of this paper for publication, 6 additional cases of Hirschsprung's disease have been encountered. Three of the patients, a nine-month-old female, a seven-year-old male, and a nine-year-old male, showed narrowed segments in the upper rectum. Two patients, a four-month-old female and a thirteen-month-old male, had contracted segments involving the entire rectum and the sigmoid colon. One patient showed an unusually long aganglionic segment. This was a thirteen-day-old male infant who was admitted to the hospital with signs of intestinal obstruction. The entire colon was seen to be diminished in caliber on barium enema study. At operation a walled-off perforation of the distal ileum was found. Histologic sections of the large and small bowel following

autopsy showed an absence of ganglion cells extending from the anus to 15 cm. proximal to the ileocecal valve. The site of perforation was at the junction of ganglionic with aganglionic bowel.

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Fig. 16. Case XII. T. B. A. Spot film of the barium-filled splenic flexure. Note the difference in caliber between the distal transverse colon and the proximal descending colon. B. Double-contrast film showing transition between the relatively normal appearing descending colon and the dilated transverse colon at the splenic flexure. C. Tracing of B, indicating the aganglionic segment in black, extending from the splenic flexure to the anus.

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SUMARIO

Megacolon Congénito (Enfermedad de Hirschsprung)

Cabe clasificar los casos de megacolon en tres grandes grupos: (1) megacolon orgánico, (2) megacolon idiopático, y (3) megacolon congénito o enfermedad de Hirschsprung. El término de enfermedad de Hirschsprung debe reservarse para los casos en que existe oclusión funcional del intestino a consecuencia de estrechez de un segmento, debido a falta (o disminución) de células ganglionares en el plexo mientérico. El segmento estenosado puede ser corto o largo y es observable roentgenológicamente, correspondiendo con mayor frecuencia a la región rectosigmoidea. Reprodúcense aquí los varios sitios afectados (Figs. 1 y 2).

Los síntomas aparentes se describen así: (1) estreñimiento crónico, (2) oclusión intestinal, (3) vómitos, diarrea y distensión abdominal, y (4) alternación de estreñimiento y diarrea.

Después de repasar las varias teorías relativas a la patogenia del estado, sugiérese que cabe explicar las varias formas de segmento agangliónico a base de un trastorno del desarrollo embriológico de las células de los ganglios intramurales en sentido cráneocaudal.

Radiológicamente, obsérvanse las siguientes formas: Forma I. La porción proximal del segmento agangliónico está contraída, mientras que la distal muestra calibre completa o relativamente normal. Forma II. Todo el segmento agangliónico está decididamente contraído. Forma III. Segmento relativamente corto de espasmo anular representando la porción proximal del segmento agangliónico. Forma IV. Segmento agangliónico aparentemente normal, pero revelando notable diferencia de calibre al compararlo con el segmento dilatado más arriba. Forma V. Dos zonas de espasmo separadas por un segmento normal de intestino.

En una serie de 18 casos, que constituye la base de este trabajo, se encontró un ejemplo de aganglia zonal doble, con falta absoluta de células ganglionares en las zonas rectosigmoidea y rectal inferior y células ganglionares normales en la porción superior del recto.

Los estudios con doble contraste han resultado valiosos para descubrir un segmento estenosado en algunos casos en que un estudio con enema de bario no fué terminante.

Observations on the Structure and Function of the Ileocecal Valve[1]

ELLIOTT C. LASSER, M.D., and LEO G. RIGLER, M.D.

DURING THE PAST ten to twelve years the ileocecal valve has commanded increasing attention from roentgenologists. Such interest has resulted in the publication of a number of papers that have contributed materially to an understanding of the normal roentgen anatomy of the area and to recognition of abnormal variations. The work of Fleischner and Bernstein (5) has been particularly outstanding in this regard.

During the same period, relatively little has been written about those structural aspects of the ileocecal valve that affect its normal dynamics. Studies by Rutherford (7), in 1914, and by Buirge (2), in 1943, have contributed to an understanding of the structural dynamics but have failed to completely elucidate them. The present study is based upon roentgenologic, histologic, and special experimental observations made during the past four years in the Department of Radiology of the University of Minnesota Hospitals. The normal roentgenographic appearance of the ileocecal valve has been touched upon by others and will be dealt with in this paper only in so far as it appears to be of importance from a functional standpoint.

SPHINCTERIC ACTION

Most investigators are in agreement that the ileocecal valve exercises its influence by virtue of both its structural design and a sphincteric action. The present paper is concerned with the purely structural or valvular action, but a brief review of the sphincteric mechanism as gleaned from a survey of the composite findings of a number of investigators (3, 7, 8, 13) seems pertinent before proceeding to the valvular component. The sphincter mechanism of the ileocecal valve functions in an area 2 to 3 cm. within the lumen of the valve from the cecal side. Its motor innervation arises from the ninth to the twelfth thoracic nerves and the first and second lumbar segments of the splanchnic nerve, mediated through the intramural plexus of Auerbach. The frequency of contractions in a normal individual appears to vary from continued contractions and relaxations over a period of an hour to periodic contractions at twenty- to sixty-minute intervals. Eating and emotional activity cause frequent contractions and relaxations in response to increased propulsive activity in the terminal ileum.

Stimulation of the cecal mucosa or distention of the colon increases the force of contraction of the sphincter. Starvation, general anesthesia, and adrenalin all relax the sphincter, while pilocarpine and acetylcholine cause a gradual increase in tone.

VALVULAR ACTION

The term "valve" stems from the Latin "valva" meaning leaf or fold, and indicates, by definition, a device for regulating or determining the direction of flow of a liquid, gas, etc., by means of a movable part which opens or closes a passage. From a physiological standpoint, the criterion of a competent valve is unidirectional flow.

That an actual valvular mechanism is an integral part of the structure of the ileocecal valve cannot be denied. Wakefield and Friedell (12) and Sperling (9), among others, have tested the efficiency of the valve in preventing the escape of air into the ileum in autopsy specimens. In almost all instances the valve permits free flow of air into the colon from the

[1] From the Department of Radiology, University of Minnesota Medical School, Minneapolis 14, Minn. A portion of a thesis submitted by Dr. Lasser to the Faculty of the Graduate School of the University of Minnesota in partial fulfillment of the requirements for the degree of Master of Science in Radiology. Accepted for publication in September 1953.

ileum, while in a variable percentage of cases, rupture of the cecum occurs before air is permitted to pass in reverse from the cecum to the ileum. Similar experiments were carried out in this study on 15 fresh autopsy specimens. In 12 instances, pressures of 8 to 32 cm. of water were sufficient to cause air to pass from the cecum to the ileum. In the other 3 cases, pressures up to 60 cm. of water did not render the valves incompetent from the cecal side.

What factors are operative in determining this purely mechanical or valvular action? To answer this question fully, one must first examine the gross anatomical structure of the valve and then attempt to relate these structural findings to the roentgenographic appearance of the valve under varying conditions.

The following description of the ileocecal valve is taken from Gray's *Anatomy of the Human Body* (6):

"The lower end of the ileum ends by opening into the medial end and back part of the large intestine at the point of union of the cecum with the colon. The opening is guarded by a valve consisting of two segments or lips which project into the lumen of the large intestine. If the intestine has been inflated and dried, the lips are of semilunar shape. The upper one, nearly horizontal in direction, is attached by its convex border to the line of junction of the ileum with the colon; the lower lip, which is longer and more concave, is attached to the line of junction of the ileum with the cecum. At the ends of the aperture the two segments of the valve coalesce, and are continued as narrow membranous ridges around the canal for a short distance, forming the frenula of the valve. Each lip of the valve is formed by a reduplication of the mucous membrane, and of the circular muscle fibers of the intestine, the longitudinal fibers and peritoneum being continued uninterruptedly from the small to the large intestine. The surfaces of the valve directed toward the ileum are covered with villi, and present the characteristic structure of the mucous membrane of the small intestine; while those turned toward the large intestine are destitute of villi, and marked with the orifices of the numerous tubular glands peculiar to the mucous membrane of the large intestine."

A number of observers take issue with the description given above. Buirge (2), Toldt (11), Rutherford (7), and Fleischner and Bernstein (5), for example, are in agreement that the upper lip of the valve is usually the longer, and these observers, as well as Bargen and his associates (1), believe that the valve does contain longitudinal as well as circular muscle fibers.

The most complete study of the anatomy of the valve has been carried out by Buirge (2), who examined 600 autopsy specimens. In 411 of 443 valves, Buirge found the superior lip to extend beyond the inferior lip. He chose to designate the reflection of mucous membrane extending from the lips proper to the frenula as "arches" and divided the valves into four types on the basis of abnormalities of the frenula. He encountered the "classical type" of valve in 54 per cent of his specimens. This consisted of a valve having upper and lower lips, superior and inferior arches bilaterally, and a frenula extending up from either side of the valve. Buirge felt that the underlying cause of an incompetent valve was absence of an arch or a frenula. He noted that when the cecum was filled with formalin solution and gradually distended, the frenula was subject to stretching and tension, affording "artificial yet dynamic action upon the structures of the valve."

Our own gross anatomical studies of the ileocecal valve showed that when viewed in profile, in a semi-relaxed colon, the valve most commonly presents an appearance similar to that shown in Figure 1. This is a specimen prepared by careful sectioning of the upper and lower lips of an ileocecal valve in normal anatomical relationships. The specimen was obtained from a cecum slightly distended with formalin solution for two or three days. From a functional standpoint, the important features to be noted are the longer length of the upper lip compared to the lower and the concave inferior surfaces of both the upper and lower lips. This "saucerization" of the under surface of the upper lip allows the slightly convex superior portion of the lower lip to nestle into close approximation in a distended colon, and will be discussed more completely in a subsequent paragraph. One can also note in Figure 1 the flattening of the villi of the ileal mucosa along the line of approximation of the lips.

When the gross anatomical specimen of the ileocecal valve is viewed in the head-on position, the upper lip is seen to be shorter and straighter than the lower lip. When the valve is sectioned in the head-on position with the plane of section passing just below the submucosal area, it is seen that the tissue planes of the upper lip appear to be in direct continuity with similar planes in the frenula, while the tissue planes in the lower lip appear to terminate at, rather than pass into, the frenular tissues. This is illustrated by Figure 2. Reference to the diagram accompanying this figure will help in orientation of the plane represented by these tissue slices. Note that only the lateral half of the axial section is demonstrated.

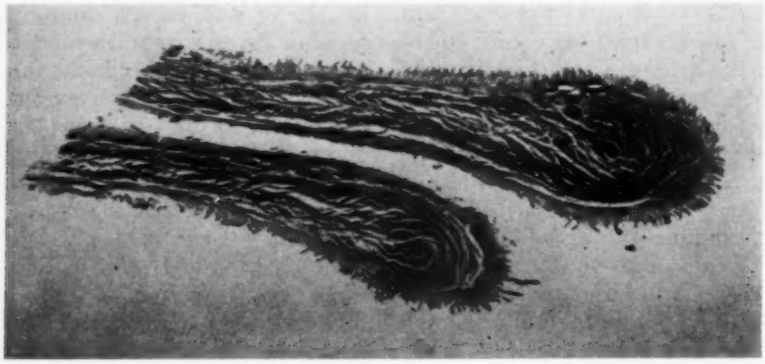

Fig. 1. Ileocecal valve, sectioned in profile, in normal anatomical relationships. Note that the mucous membrane is flattened along the area of approximation of the upper and lower lips.

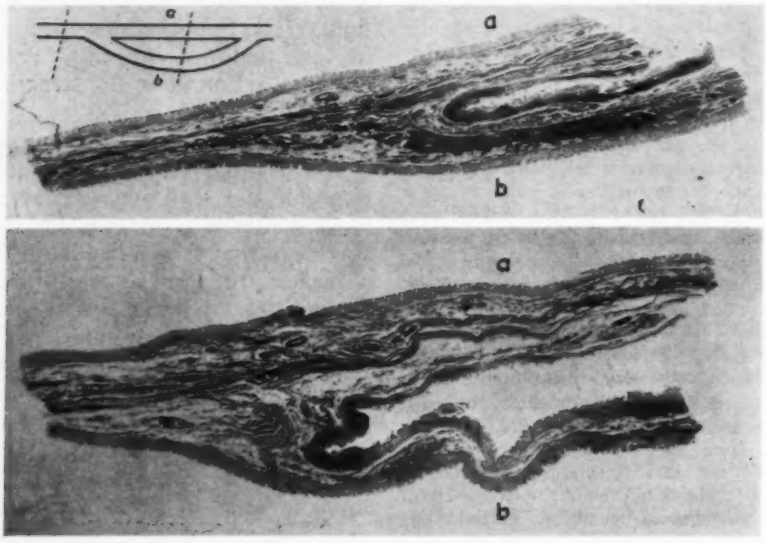

Fig. 2. Lateral portions of ileocecal valves sectioned in the head-on position: (*a*) upper lip; (*b*) lower lip. The plane of section cuts through the submucosal area in each case. Note the apparent continuity of the lateral frenular tissues with the tissues of the upper lip.

If one isolates the ileocecal valve in the gross anatomical specimen and places ten-

Fig. 3. Air-contrast study of the colon. The ileocecal valve can be made out in soft tissue relief. Note that the lower lip (arrow) is still somewhat lax, while the upper lip appears nearly taut.

sion upon its two lateral margins, it will be noted that this tension is transmitted directly to the upper lip which, being shorter from side to side than the lower lip, reaches its ultimate stretch while the lower lip has not yet stretched into horizontal approximation with it. This is illustrated *in vivo* in Figure 3, which is a soft-tissue relief of the ileocecal valve undergoing a stretching tension in an air-filled cecum. In this distended cecum the upper lip has been stretched into a horizontal position, while the lower lip (arrow) still appears somewhat lax. It must be borne in mind that the stretch phenomena mentioned above occur only in a relaxed valve, or one where the sphincteric contraction has been overcome.

If one studies the roentgen characteristics of the ileocecal valve as viewed in profile under varying conditions of cecal distention and in different individuals, it will be seen that the lower lip may pass into the lumen of the colon in a plane that varies from parallel approximation with the upper lip (Fig. 4) to almost a vertical perpendicular to it (Fig. 5). This plane

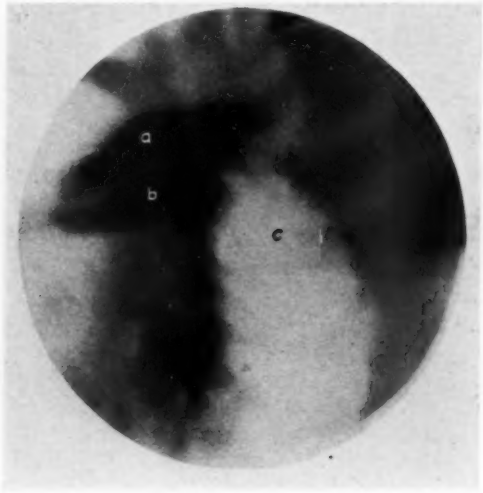

Fig. 4. Spot film over the ileocecal valve showing parallel approximation of the upper and lower lips as viewed in the profile position: (*a*) upper lip; (*b*) lower lip; (*c*) terminal ileum.

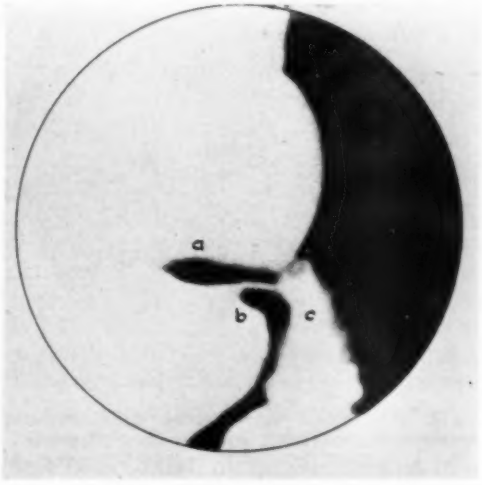

Fig. 5. Spot film over the ileocecal valve showing the lower lip almost perpendicular to the upper lip: (*a*) upper lip; (*b*) lower lip; (*c*) terminal ileum.

of inclination of the lower lip varies in a single individual from time to time, depending on the amount of cecal distention. It is this flexibility of position of the lower lip in contradistinction to the relative rigidity of the upper lip in the distending colon that is singularly important in the mechanics of the valve.

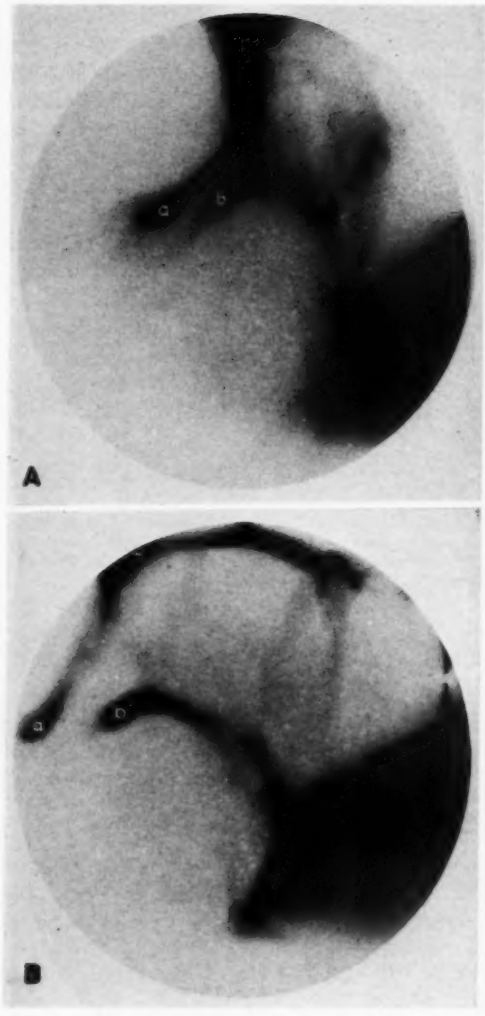

Fig. 6. Ileocecal valve studies with increasing distention of the cecum: (*a*) upper lip; (*b*) lower lip.
A. Competent ileocecal valve with the upper and lower lips in approximation.
B. The effect of increasing distention of the cecum is here shown. The valve is now incompetent.

As noted above, in 12 out of 15 fresh autopsy specimens, air pumped into the colon under varying pressures could be made to pass from the cecum to the ileum. In these cases, in which incompetency to pressure of air from the cecal side was observed, the terminal ileum was cut across at its junction with the colon, and the valve was observed from behind as the cecum was progressively inflated. What was noted in every instance was a gradual separation of the base of the lower lip from the base of the upper lip, with backward displacement of the puffed out midportion of the lower lip until its free edge

Fig. 7. Thickened ileocecal valve in patient with chronic ulcerative colitis: (*a*) upper lip; (*b*) lower lip.
A. Valve shown in state of transient competency.
B. Effect of increasing distention of the colon; lower lip moves back, allowing passage of barium into the terminal ileum.

lost contact with the under surface of the upper lip, and an air passage presented itself in the intervening space. This same finding, namely, rigidity of the upper lip and first upward and then backward dis-

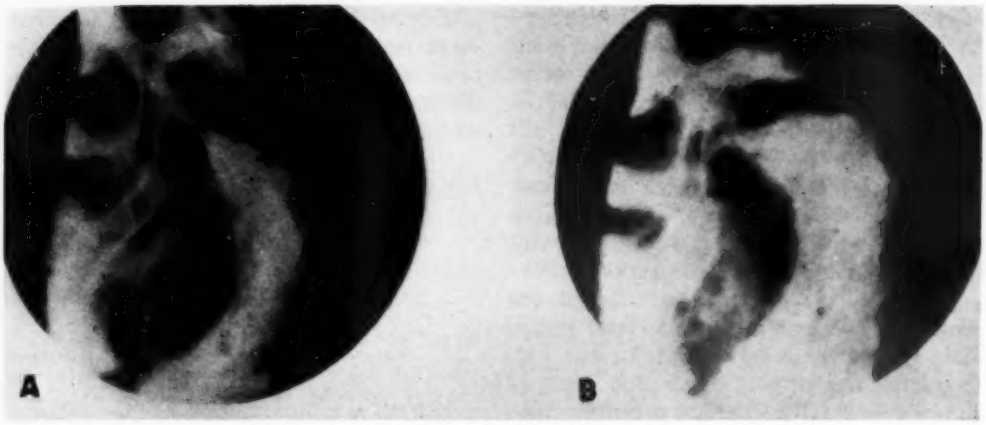

Fig. 8. Barium in the cecum and terminal ileum. The ileocecal valve is shown in profile.
A. Appearance of valve with bowel in resting state.
B. A peristaltic wave is passing down the terminal ileum. There has been some change in position of both lips in this instance.

placement of the lower lip in the progressively inflated colon, was also verified by observing the valve from the cecal side through a cystoscope, as the cecum was progressively distended.

This finding may be illustrated *in vivo* by profile compression roentgenograms of the ileocecal valve with first moderate, and then increasing distention of the cecum by a barium enema. Figure 6A shows the two lips of the valve in approximation, the convex upper portion of the lower lip nestled against the concave lower portion of the upper lip. The valve is now in a competent state. With increasing pressure (Fig. 6B), the lower lip loses contact with the upper lip, moving downward and backward to assume a more vertical position. The upper lip remains relatively immobile in both the open and closed phases of the valve.

Similar findings are illustrated in Figures 7A and B, which show the ileocecal valve of a patient with chronic ulcerative colitis. It should be noted, in this instance, that there is a noteworthy thickening of the ileocecal valve, which precludes any tendency for the lower lip to lose its curve and become more vertical with increasing distention. Nevertheless, the rigidity of the upper lip and the mobility of the lower lip in the distended colon can be noted.

When barium enters the cecum from the terminal ileum, the factors mentioned above are non-operative. Figure 8A shows barium in the terminal ileum and a small amount of barium in the cecum. Figure 8B shows the same ileocecal region several minutes later, with a peristaltic wave proceeding down the ileum, forcing barium into the cecum. The characteristic "crest formation" of the terminal ileum as it empties its barium into the cecum may be noted. The lower lip of the ileocecal valve can be seen to be displaced downward and forward as the contents of the ileum empty into the cecum. The upper lip of the valve, in this instance, shows some change in position as well. This change in position of the upper lip, in contradistinction to its semi-rigid state in the distended colon, may be explained by the fact that no frenular pull is put upon the lip in the semi-empty colon and so it, too, may be influenced by the barium stream in this state.

COMMENT

From the studies cited above, it seems apparent that the ileocecal valve should not be regarded as categorically "competent" or "incompetent." It would seem more reasonable in most instances to assume that each valve undergoes successive states of competency and incompetency as

increasing tension is placed upon the cecum. As mentioned in experimental studies cited earlier, some valves appear to be completely competent regardless of the degree of tension placed upon the cecum and will allow rupture of the cecum before allowing passage of air into the terminal ileum. In many instances, the pressures necessary to force the valve from the cecal side will be higher than those found experimentally and in clinical cases of large bowel obstruction, as recorded by Sperling, Paine, and Wangensteen (10) and Dennis (4). In many cases, also, it seems probable that the valve will fail to yield to pressures from the cecal side which may be higher than those in the terminal ileum. Under such circumstances, the pressure of distended small bowel need not necessarily indicate an incompetency of the ileocecal valve. The gas in the small bowel in such cases may very likely be due to a secondary obstruction established at the site of the ileocecal valve due to inability of the pressures then present in the terminal ileum to overcome the pressure in the segment beyond the valve.

CONCLUSIONS

1. The ileocecal valve appears to exercise both a sphincteric and a true valvular action.

2. The structural characteristics of the valve cause the upper lip to assume a passive role in the process of closure of the valve in a distended colon while the lower lip assumes a mobile active part.

3. On theoretical grounds it does not seem necessary in all cases to postulate incompetency of the ileocecal valve when distended small bowel is seen in the presence of colonic obstruction.

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SUMARIO

Observaciones Relativas a la Estructura y la Función de la Válvula Ileocecal

Este trabajo versa sobre las fases estructurales de la válvula íleocecal que afectan la dinámica normal de la misma. Básase en observaciones roentgenológicas, histológicas y experimentales especiales verificadas durante un período de cuatro años en el Departamento de Radiología de la Universidad de Minnesota.

La válvula íleocecal parece desplegar una acción tanto esfintérica como valvular verdadera. Las características estructurales de la válvula hacen que su labio superior desempeñe un papel pasivo en el proceso de clausura de la válvula en un colon distendido, mientras que el labio inferior toma una parte activa movible.

Los estudios aquí presentados indican que no debe considerarse categóricamente

a la válvula como "suficiente" o "insuficiente." En la mayor parte de los casos, parece más lógico dar por sentado que cada válvula atraviesa etapas sucesivas de suficiencia e insuficiencia a medida que se impone mayor tensión al ciego. Algunas válvulas parecen ser absolutamente suficientes por grande que sea la tensión.

En algunos casos, parece probable que la válvula no cederá a presiones del lado cecal que sean superiores a las derivadas del ileon. En esas circunstancias, la compresión del intestino delgado distendido no indica forzosamente insuficiencia de la válvula íleocecal. En esos casos, parece muy probable que el gas del intestino delgado proceda de una oclusión secundaria situada en la válvula íleocecal y debida a incapacidad de las presiones existentes entonces en le porción terminal del íleon para vencer la presión ejercida en el segmento de más allá de la válvula.

Supervoltage and Multiple Simultaneous Roentgenography—New Technics for Roentgen Examination of the Chest[1]

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WHILE THE survey chest roentgenogram is one of our best diagnostic tools, experience has shown that conventional roentgenographic methods fail to record some significant lesions, most notably those which occur within the mediastinum (1). Bronchogenic carcinoma frequently involves the structures of the mediastinum before peripheral roentgenographic evidence of disease is apparent. It is felt, therefore, that the development of a roentgenographic technic adaptable to mass screening methods, which would demonstrate the lung fields *and* the mediastinal structures, would be of great value in the early detection of cancer of the lung.

It is possible, to be sure, to study both the mediastinum and the lung fields with conventional technics. The authors believe, however, that these conventional methods are not satisfactory for mass survey studies, since they require multiple exposures. As the number of exposures needed per patient increases, the cost of the examination rises, the roentgen dose to the patient becomes larger, and the number of patients that a given diagnostic unit can serve decreases. Added to these difficulties, is the very considerable problem of the interpretation of a greatly increased number of roentgenograms. For these reasons, a mass screening program based on multiple exposure technics appears to be impractical, and the advantage of a procedure with which more diagnostic information might be recorded in a single exposure appears obvious.

The purpose of this discussion is to consider new approaches to the solution of this problem, and to present early clinical impressions of supervoltage roentgenography, which appears to be the most promising new technic that we have studied.

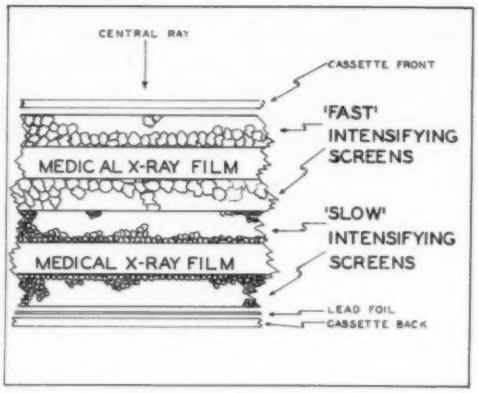

Fig. 1. Diagram of a cross section through a cassette designed for multiple simultaneous roentgenography, showing the relative positions of the intensifying screens and the films.

MULTIPLE SIMULTANEOUS ROENTGENOGRAPHY

New methods are perhaps best suggested by a consideration of the inadequacies of conventional roentgenograms. One major defect in the present survey chest study is that the mediastinal shadow is an area of "under-exposure" and is therefore characterized by a very low film contrast factor (2). This makes impossible the demonstration of critical details in this area. In more heavily exposed roentgenograms, the mediastinal details can be recorded much more adequately (provided a grid is employed), but in such a study the lung fields are said to be "burned out," *i.e.*, they are

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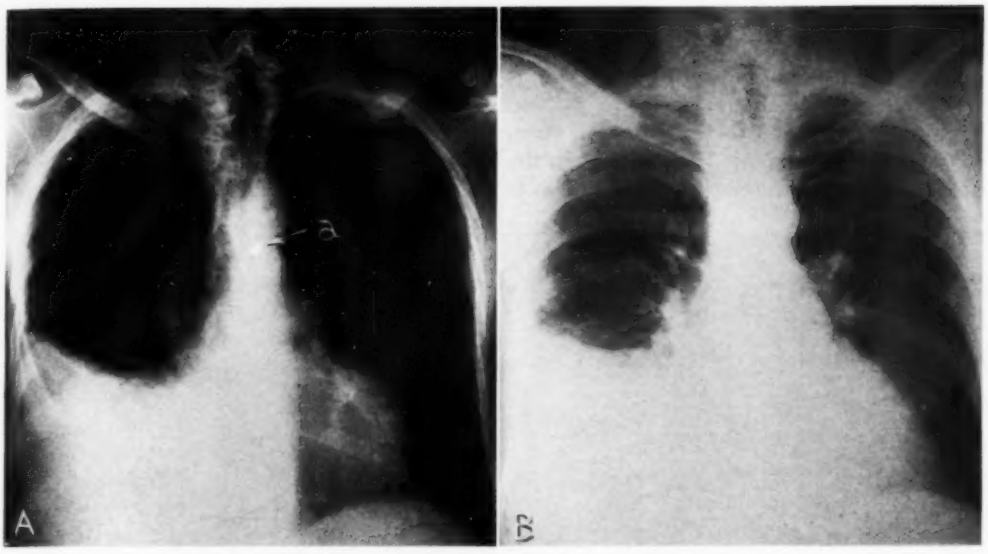

Fig. 2. Simultaneously exposed roentgenograms of the human chest. Film A, exposed between "fast" fluorescent intensifying screens, records the grosser structures of the mediastinum. Film B, exposed between "slow" intensifying screens records the details of the lung fields. Note the piece of shrapnel at *a* which is not visible on film B, and which had repeatedly escaped detection on previous survey examinations.

not sufficiently bright for optimum contrast perception when viewed on a conventional illuminator (8). In brief, the roentgen-ray absorption of the mediastinum is so great, relative to that of the lung fields, that it is impossible to record both satisfactorily on a single sheet of film if conventional radiation is employed.

A possible solution to this problem lies in the use of a cassette containing two pairs of fluorescent intensifying screens, one pair of which is coated with a "faster" phosphor than the other (Fig. 1). By exposing one sheet of film between the two "fast" screens and simultaneously exposing another sheet of film between the two "slow" screens, it is possible to produce two roentgenograms of different densities with a single exposure. If the radiographic factors are properly selected,[4] a film exposed between the "fast" screens will record the grosser structures of the mediastinum, while one exposed between the "slow" screens will record the details of the lung fields (Fig. 2). This technic yields more information than a single conventional survey study, yet avoids some of the disadvantages of multiple exposure technics. It should be noted, however, that certain technical problems relative to the construction of such cassettes have not yet been solved.[5]

SUPERVOLTAGE ROENTGENOGRAPHY

Rationale: The detection of small intrathoracic soft-tissue lesions can be shown to be limited in yet other ways by the relatively great roentgen-ray absorption of the background structures in certain portions of the chest, notably the mediastinum, but to a lesser extent the lateral chest wall and other parts containing bone.[6] Since the high background absorption of these parts is due to their bony content, one might

[4] The following exposure factors are satisfactory for the examination of patients of average size (21–23 cm.) in the postero-anterior projection and have been used in our studies: 100 kv.p., 100 ma., 1/5 second, 50-inch target-film distance. An 8:1 Potter-Bucky diaphragm is used. Both studies are made on *Kodak Blue Brand X-ray Film*, one sheet of which is exposed between *Patterson Par-Speed Intensifying Screens;* the other, between *Patterson Detail Intensifying Screens.*

[5] It is difficult to insure satisfactory contact between the films and screens in such a cassette.

[6] Skeletal structures overlie approximately 70 per cent of the projected area of the thoracic cavity on a chest roentgenogram.

reason that if the absorption of bone were reduced, relative to that of soft tissue, the detection of intrathoracic soft-tissue lesions would be more likely.

Another approach to the problem, then, is to attempt to exploit the decrease in the absorption of bone relative to that of soft tissue which is associated with an increase in the kilovoltage applied to the roentgen-ray generator (Fig. 3).[7]

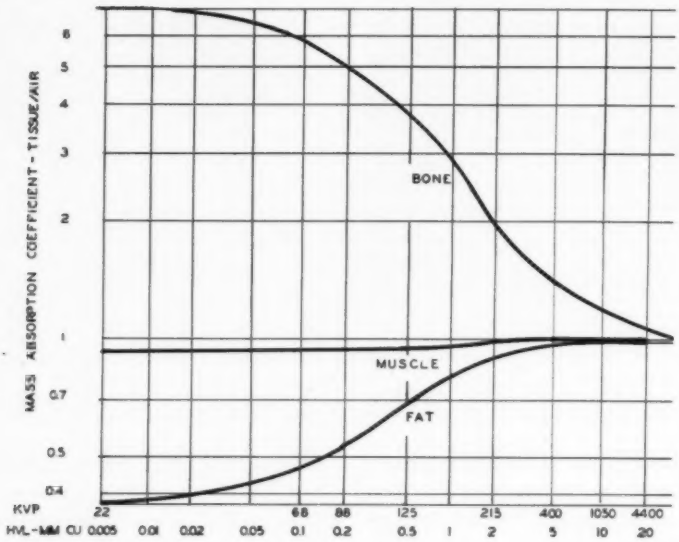

Fig. 3. Curves showing relative mass absorption coefficients of various types of tissue with respect to radiation generated at various kilovoltages (after Wachsmann).

Spiers (4), Wachsmann (7), and others have shown that the mass absorption coefficient of bone is appreciably smaller, relative to that of soft tissue, for radiation generated between 200 kv. and 5,000 kv. than it is for radiation generated in the 50 kv. to 200 kv. region (Fig. 3). From this and other theoretical considerations (6), it would appear that the detection of soft-tissue lesions overlying skeletal structures would be most likely if supervoltage radiation were employed in chest roentgenography. Accordingly, with the cooperation of the X-ray Department of the General Electric Company, the High Voltage Engineering Corporation, and Massachusetts General Hospital, a technic of chest roentgenography employing this very short-wave-length radiation has been developed and subjected to a limited clinical trial.

In Table I, conventional and supervoltage technics[8] are compared with respect to exposure factors and dose to the patient. As an objective indication of the relative visibility of soft-tissue lesions in the two types of study, we have also stated the thickness of the smallest Lucite test object visible over the mediastinum in representative examples of the two types of examination.

[7] The use of so-called "high-kilovoltage" roentgenography (3, 5) may be regarded as one attempt to take advantage of the more uniform absorption characteristics resulting from the use of shorter-wave-length radiation. The authors have attempted to compare objectively image visibility in conventional and high-kilovoltage chest studies by comparing the frequency with which randomly distributed Lucite test objects are detected in the two types of study. No significant improvement in the visibility of these soft-tissue equivalent details has been found to result from the use of radiation generated at 120–130 kv.p. These studies, sponsored by the Picker X-ray Corporation, are still in progress and will be reported in the future.

[8] The data in Table I refer to the technic employed in using a resonance transformer type of generator. The clinical studies cited have all been made with a Van de Graaff type of generator using the following factors: 2,000 kv., 100 microamperes, 3 seconds, and 56-inch target-film distance. The exposures have all been made on *Ansco Superay C X-ray Film* or *Kodak No-Screen X-ray Film* between lead-antimony intensifying screens 0.005 inch thick.

TABLE I: COMPARATIVE PHYSICAL DATA FOR SUPERVOLTAGE AND CONVENTIONAL CHEST ROENTGENOGRAPHY (5)

Kv.	Ma.	Seconds	Target—Film Distance (inches)	Dose in Air at Skin Level (r)	Thickness of Least Perceptible Lucite Disk Overlying the Spine (inches)
2,000	0.5	2.0 plus build-up	112	0.8	0.2
80	100	0.05	72	0.02	1.5

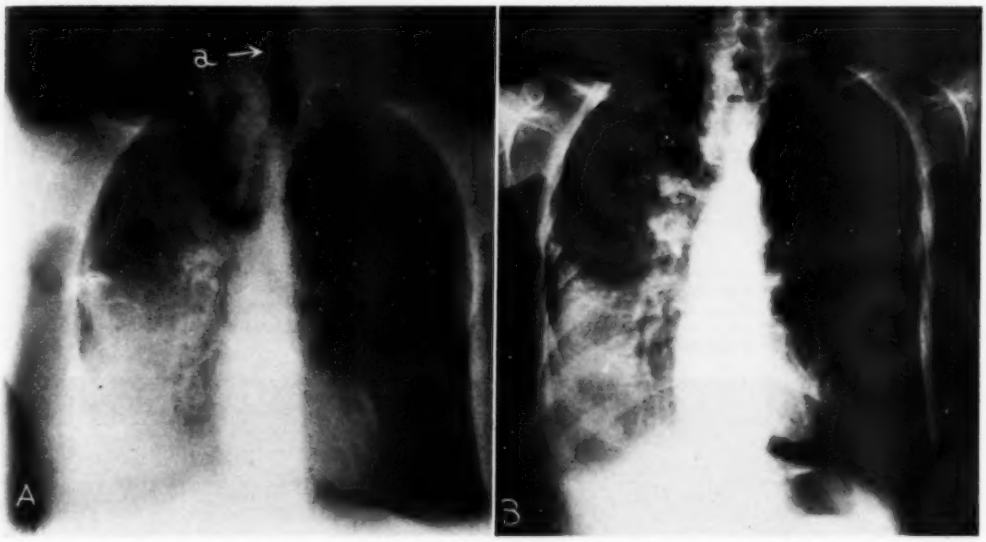

Fig. 4. Comparative roentgenograms of a case of old bilateral tuberculosis illustrating the relative visibility of the structures of the chest in supervoltage (A), and conventional (B) examinations. Note that in contrast to the conventional study (B), the supervoltage study (A) records the details of the mediastinum *and* of the lung fields in a single exposure, and contains no area bright enough to produce glare. Note especially the detail visible in the larynx, *a*, in the supervoltage roentgenogram.

It should be noted that the dose in air at skin level delivered in supervoltage roentgenography, while much larger than that associated with conventional chest studies, is about equal to that delivered in photofluorography of the chest. The exposure time in supervoltage studies is very long, partly because of the insensitivity of film emulsions to such short-wave-length radiation, and partly because of the low output of the generators. We believe that these disadvantages are outweighed by the fact that very much smaller objects, equivalent in density to soft-tissue details, are visible in the mediastinal area of the supervoltage studies than are visible in the same area of conventional roentgenograms.

Clinical Impressions: The clinical experience with supervoltage roentgenography, to date, is too limited to permit a statistical evaluation of the diagnostic usefulness of the method. The following impressions, however, appeared to be justified:

1. Supervoltage studies consistently demonstrate mediastinal structures, including the larynx, trachea, main-stem bronchi, aorta, and the mediastinal portions of the lungs, to much better advantage than conventional studies.

2. Deformities (Fig. 4), constrictions (Fig. 5), and filling defects in the tracheobronchial tree (Fig. 6) are better shown than in conventional studies.

3. Emphysematous bullae, air-filled cavities, and areas of abnormal ventilation in the lung have been better demonstrated than in conventional studies (Fig. 7).

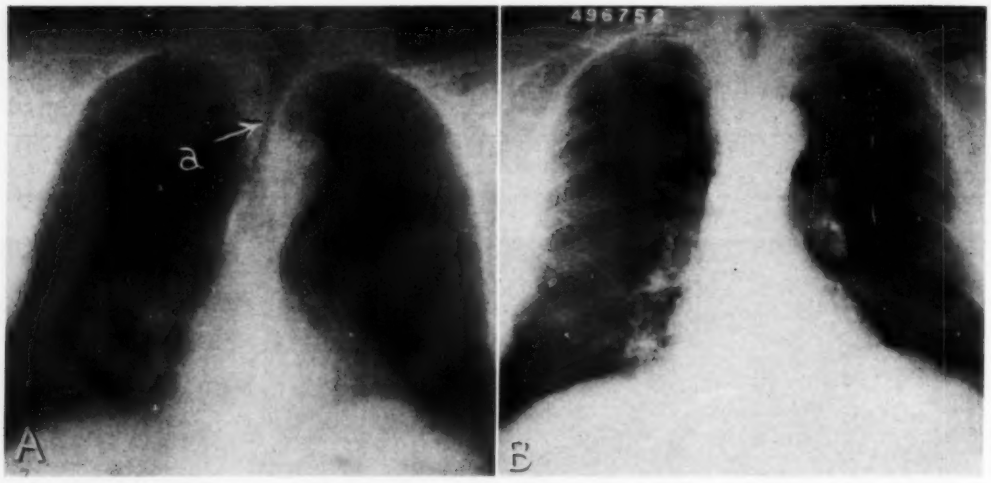

Fig. 5. Roentgenograms illustrating the comparative visibility of a tracheal constriction in supervoltage (A) and conventional (B) examinations. Study A was made with two-million-volt radiation; study B with conventional factors (90 kv.p., fixed grid). The presence of a lesion constricting the trachea is clearly demonstrated in the supervoltage roentgenogram at *a*. It is much less obvious in the conventional exposure. The patient left the hospital before a definitive diagnosis could be made.

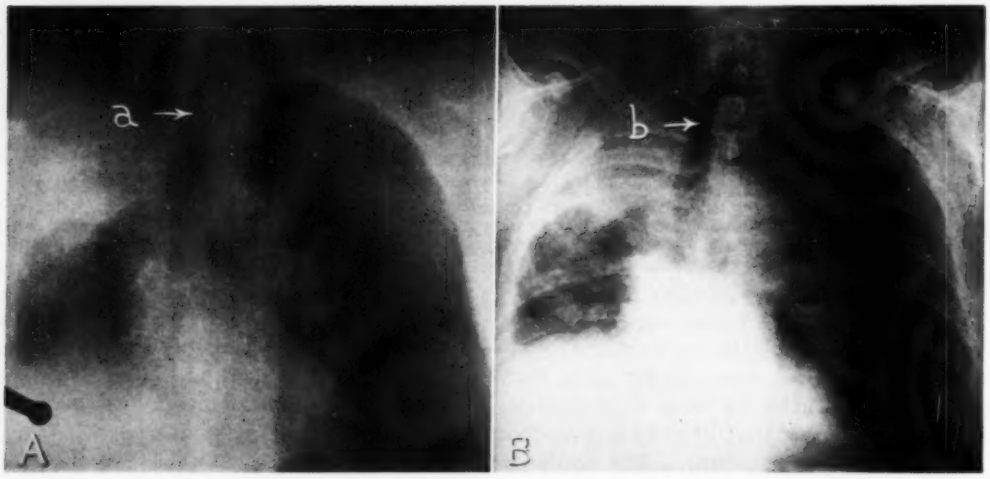

Fig. 6. Roentgenograms illustrating the relative visibility of a soft-tissue mass in the trachea in supervoltage (A) and conventional (B) examinations. Study A was made with two-million-volt radiation; study B with conventional exposure factors. The lesion is clearly seen at *a* in the supervoltage study, but is distinguished with difficulty from the overlying structures, *b*, in the conventional exposure.

4. Parenchymal details, on the other hand, though they lie within the optimal density range, are somewhat blurred in supervoltage studies by the motion of the anatomic structures during exposure. Efforts are now being made to lessen the necessary exposure time in order to reduce this form of unsharpness.

Current Status: Supervoltage diagnostic roentgenography is at present entirely experimental. It has been shown to be a useful adjunct to conventional roentgenographic methods, and it is believed that it will in time prove to be useful for survey studies simply because it permits one to record, in a single exposure, more informa-

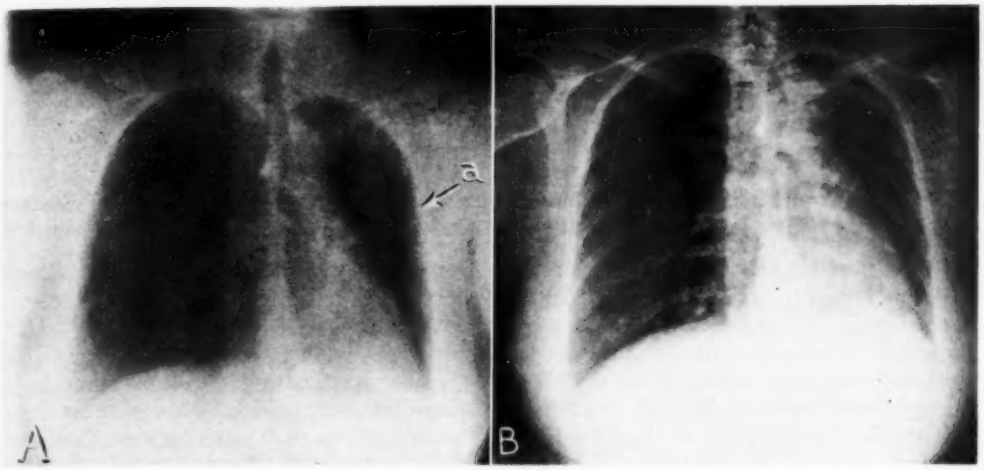

Fig. 7. Roentgenograms illustrating the comparative visibility of an emphysematous bulla in supervoltage (A) and conventional (B) examinations. Study A was made with two-million-volt radiation; study B with conventional factors (90 kv.p., Potter-Bucky diaphragm). This is a proved case of bronchial adenoma obstructing the left upper lobe bronchus. The presence of a large bulla in the lingula (confirmed at operation) is clearly visible in the supervoltage study at *a* but cannot be seen in the conventional roentgenogram.

tion relative to the soft tissues of the chest than does any other technic. The cost and scarcity of supervoltage generators, however, prevent its use in this manner at present. We are hopeful that these obstacles will be overcome, since supervoltage roentgenography may be applicable not only to the study of the chest, but to a wide range of roentgenographic problems, including multiple simultaneous laminagraphy and air-contrast studies of the cerebral ventricles, the lumbar sac, the urinary bladder, the stomach and colon, and the joint spaces.

SUMMARY

In summary, it is believed that the development of a technic of survey chest roentgenography which, in a single exposure, would give diagnostic information about the mediastinum as well as the lung fields would be of great value in the early detection of bronchogenic carcinoma, as well as other chest lesions. Multiple exposure technics are the best substitute for such a method at the moment, but these are not suited to the roentgenographic screening of large population groups. On the basis of preliminary studies, it appears that supervoltage roentgenography is potentially a practical solution to this problem and may have wide application in the roentgen study of other organ systems. The clinical impressions gained from a limited trial of the technic are encouraging, and further investigation of the method appears to be warranted.

ACKNOWLEDGMENTS: We wish to express our sincere appreciation to the staffs of the X-ray Department of the General Electric Company, the High Voltage Engineering Corporation, and the Massachusetts General Hospital, for their cooperation in this study.

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SUMARIO

La Roentgenografía Simultánea de Supervoltaje y Múltiple—Nuevas Técnicas para el Examen Roentgenológico del Tórax

Según parece, sería de mucho valor para el descubrimiento temprano del carcinoma broncógeno, así como de otras lesiones torácicas, la elaboración de una técnica para las encuestas radiográficas del tórax, que proporcionara, en una sola exposición, información diagnóstica acerca del mediastino así como de los campos pulmonares. De momento, las técnicas de exposición múltiple representan el mejor substituto de dicho método, pero no se prestan para el despistaje roentgenográfico de grandes grupos de población.

A base de estudios preliminares, parece que la roentgenografía de supervoltaje (2,000 kv.) ofrece potencialmente una solución práctica de dicho problema y tal vez encuentre amplias aplicaciones en el estudio roentgenológico de otros sistemas y aparatos del cuerpo. Las impresiones clínicas derivadas de un ensayo limitado de esta técnica son alentadoras. Observóse que suministraba exposición superior de los órganos mediastínicos, comprendiendo laringe, tráquea, principales conductos de los bronquios, aorta y porciones mediastínicas de los pulmones. También ponía de manifiesto, con mayor claridad que en las radiografías corrientes, las deformidades, estrecheces y nichos del árbol tráqueobronquial, así como las flictenas enfisematosas, las cavernas llenas de aire y las zonas de ventilación anormal en el pulmón. Por otro lado, los detalles del parénquima aparecían algo borrosos debido al movimiento de los tejidos durante el largo período de exposición que resulta necesario.

DISCUSSION

Laurence L. Robbins, M.D. (Boston Mass.): The authors are to be congratulated on a most interesting research project. Although for several years similar studies have been attempted in part in certain centers, the information obtained has heretofore not been assembled in such a complete and concise manner.

Furthermore, this study shows that supervoltage roentgenography can produce a film of superior quality that may in some instances reveal more than single films obtained by conventional methods. Such results should rightly be considered remarkable when one appreciates the crude diagnostic methods that are available with these machines which are devised for industrial or therapeutic use.

In all sincerity, however, its value as a survey method must be questioned. I believe that at the present time, under optimal circumstances, the same information can be obtained by the use of high-kilovoltage grid films. However, it is perfectly possible that the future will allow better films than those now available, by supervoltage technic. This will require (1) a more adequate timing shutter; (2) a smaller focal spot; (3) better means of diaphragming; (4) more reasonably priced equipment, and (5) a better x-ray film, preferably one without grain and one of much greater sensitivity than those now available. In other words, this more or less puts the problem in the hands of the commercial producers.

I disagree with the assumption that comparison of plastic objects on the outside of the body can be made with true lesions of similar size under anatomic conditions. It must be remembered that air is the best known contrast agent we have in the supervoltage ranges, and when one uses a plastic object on the outside of the body, he must be sure that it is not surrounded by air if he is not to be led astray. I think this aspect of the problem requires much more study.

Again I should like to say that I consider this an excellent and very clear presentation. But I shall take this chance to prophesy that this material may well become buried in the literature for a questionable period of time. How long? Maybe ten, maybe fifty years. Then someone will repeat this work and perhaps investigate the literature and suddenly find it has already been done and done

superbly. They will be amazed that anyone in this mid-century era could have had such vision and foresight.

L. Henry Garland, M.D. (San Francisco): I think it should be mentioned that the films themselves made with this technic are distinctly better than the slides suggest. Dr. Pendergrass kindly showed me a few of these films about a year ago at a meeting in New York and they are really very remarkable. When the time factor is brought under control, they should be still better.

There are two minor points of terminology that I would like Dr. Tuddenham to discuss briefly when he closes. Unfortunately the public and many of the profession receive a false connotation from the word "super"; they think that *super*voltage implies *super*-effects. I wonder, therefore, if a better word might not be megavoltage or ultra high voltage.

Secondly, the author hopes that by this technic we may detect more *early* bronchogenic carcinomas. I think he means *small* bronchogenic carcinomas. We now know that many of these tumors are present either *in situ* or as a preinvasive phenomenon for years; therefore, by the time they are large enough to cast a shadow, they are no longer early. Even though small, they are still hard to cure because they are biologically bad.

W. Edward Chamberlain, M.D. (Philadelphia): I don't know whether Dr. Charles Vaughan from Canada is in the room. I wish he were, because it would be much more fitting for him to make mention of this than for me. During the Second World War, while he was in uniform (Canadian Navy), he came to Philadelphia and picked me up, and he and I took a cadaver and some phantoms and went down to Stump Neck in Virginia, where the Navy loaned us a two-million-volt Van de Graaff. We played around with it and made some discoveries but gave up the possibilities as for the future.

We did, however, have the advantage of working with a focal spot of 0.1 mm. at two million volts. The current was 300 microamperes, 0.3 of a milliampere.

I believe this must have been about 1943.

Dr. Tuddenham (*closing*): I want to thank the discussants for their interest in our work, and I should like to comment specifically on Dr. Garland's remarks. First, with regard to the proper name for this technic, we have been concerned primarily with distinguishing the technic described today from that developed by Dr. Trout and others—so-called "high-kilovoltage" technic—which involves the use of 130 to 150-kv. radiation. We have used the word "super" only because it has already been applied to the megavoltage therapy units which we have employed in our diagnostic studies.

Second, we base the statement that we hope we can diagnose bronchogenic carcinoma "earlier" on the following reasoning. We feel that very commonly the roentgenographic findings of bronchogenic carcinoma are secondary peripheral manifestations of a central lesion obstructing a bronchus. We hope that a method such as supervoltage roentgenography which will show us defects in the tracheobronchial tree may permit us to detect the central tumor nodules before they become large enough to obstruct a bronchus and produce such peripheral signs as atelectasis, pneumonitis, and obstructive emphysema. Whether we can detect the tumors early enough to treat them effectively or not remains to be seen. We do not mean to imply that we can now see smaller nodules *in the lung field* with supervoltage than with conventional technic. Perhaps in the future this may be possible, but for the moment our exposures are so long that unsharpness due to motion makes it impossible to detect nodules much smaller than those which we see in conventional studies. We believe that the rather large focal spot of most available generators is also a very real handicap in this respect, and we would certainly like to be able to work with a focal spot a tenth of a millimeter in diameter such as Dr. Chamberlain has described.

Surgery and Radiation in Cancer of the Female Breast[1]

FREDERICK W. O'BRIEN, M.D.,[2] and FREDERICK W. O'BRIEN, JR., M.D.[3]

A REVALUATION of both surgery and radiation in the treatment of cancer of the breast seems impelling because of recently advocated surgical procedures and the progressively higher radiation intensities now available.

Today, the surgical approach in the treatment of cancer of the breast seems primarily to be based on technical operability. Its limitations are evident. There is far from unanimity among surgeons as to what constitutes an operable case. Haagensen and Stout (1) have presented their criteria of operability; bilateral mastectomy is advocated by Pack (2); supraclavicular dissection, excision of the internal mammary chain of nodes, and mediastinal dissection are described by Wagensteen (3); and radical mastectomy in continuity with *en bloc* resection of the internal mammary lymph node chain is reported by Urban (4); while Orr, Harrington (5), and others consider inflammatory carcinoma of the breast operable, whether or not it is complicated by pregnancy.

Meigs (6), discussing these radical procedures in 1950, remarked, "I am prompted to say that we may be carrying surgery too far."

Stone (7) recently wrote, "The mere extensiveness or radicalness of a proposed operation is not so much under discussion as is the appropriateness of that sort of an operation for the therapy of cancer.

"At once it is seen that actually surgery may be employed for either one of two different purposes, and one should clearly distinguish between them. It may be employed with the consciously limited objective of palliation of symptoms, or for the larger aim of cure, which may better be called prolonged and indefinite recovery. To make a palliative procedure more radical is a contradiction in terms and in ideas.

"What is the probability that we shall shorten the patient's actual time of survival? It is great. What is the likelihood that the survival period, long or short, will be one of distress and disability? It is great. What is the chance that the patient will be committed to more costly treatments? It is great. Finally, what is the chance that the patient will die ultimately of his disease, despite the heroic surgery? It is very great."

Surgical procedures have gone so far that now the moralists have entered the picture. Ford and Drew (8) examine this phase at length.

It is our belief that further improvement in surgical technic will not alter end-results unless the surgeon replaces his thinking in terms of "technical operability" with that of "surgical curability," as Portmann (9) and others have suggested.

The overall figures from the best surgical clinics vary greatly. The highest five-year survivals are in breast cancer without axillary metastases. With axillary node involvement, the survival rate falls 100 per cent.

McWhirter (10) may be on the right track. If he is, a radical change in both surgical and radiation technics will be required. He does a partial mastectomy followed by roentgen therapy. His premise is that surgical removal of the lymph nodes is unnecessary when the axilla is not involved and often fails when it is involved. Heretical, his method has been termed; nevertheless, his figures are challenging and cannot be discounted lightly.

Peters (11), in a critique of McWhirter's surgical and radiation approach, concludes

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[1] Presented at the Thirty-ninth Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 13–18, 1953.

[2] Professor Emeritus of Radiology, Tufts College Medical School, Boston, Mass.

[3] Associate in Radiation Therapy, Lahey Clinic, and Research Associate in Electrical Engineering, Massachusetts Institute of Technology, Boston, Mass.

that radical surgery remains the method of choice.

Smithers *et al.* (12), in a comparison of results of treatment of patients with breast cancer at various centers according to stage distribution of all new patients seen, show an absolute survival rate of 47 per cent for Haagensen and 44 per cent for McWhirter. They point out that Haagensen's cases must be regarded as a highly selected group biased toward the less advanced and less malignant, and not comparable with those usually seen in large general hospitals.

The recent work of Handley and Thackray (13) would appear to bear out the need of a revaluation of surgical technics in breast cancer. They explored the anterior mediastinum through the second or third intercostal space in 50 consecutive patients; in 47 cases the intercostal space was explored immediately before or during a mastectomy and in 3 cases, when this was done as a preliminary procedure, it showed such heavy invasion of the space that surgery was abandoned in favor of radiotherapy. The internal mammary chain was involved in 19 cases. In 16 of these, both the axillary and internal mammary nodes were invaded. The axilla alone was invaded in 15 cases. In 16, no lymph node deposits were found anywhere.

These workers point out that when cancer cells have reached the internal mammary lymphatic chain they are inside the bony cage of the chest, separated from the pleura by only a few millimeters, and safe from the radical mastectomist. The unfortunate patient showing such invasion harbors a carcinoma which must be assigned to Stage III.

Without this evidence, Handley and Thackray's cases would have been classified as 19 in Stage I, 27 in Stage II, and 4 in Stage III. In actual fact, there were 16 Stage I cases, 14 of Stage II, and 20 of Stage III.

Haagensen at Houston (Sept. 25, 1952) stated that he had added metastatic mammary nodes to his criteria of inoperability and that for a year and a half he had been following Handley's procedure of exploring the intercostal spaces.

In reviewing the literature, it appears to us that the value of irradiation of the breast has been minimized out of all proportion. Too often, irradiation has been abandoned before having been given a fair trial and casually dismissed as palliative.

One of us has had some experience with 2,000-kv. rotation therapy during the past years, with so-called "scanning" to protect normal tissue other than the breast. Appraisal of the method, together with other newer radiation methods and "commando" type surgery, must await the verdict of time. This does not mean, however, that we must sit by while experimental technics are employed at research institutions. There is ample evidence of the value of roentgen radiation in the 200- to 400-kv. range, such potentials being universally available and effectual.

Lymphedema as a post-irradiation sequel is often stressed as a deterrent and, in our opinion, quite without adequate proof. The best surgeons admit 10 per cent of lymphedema when no irradiation is used. McWhirter, using irradiation in all cases, has seen lymphedema in less than 1 per cent, which is in accord with our own experience.

Lymphedema as a complication in radical surgery for carcinoma of the breast has been recognized since the times of Halsted and Willy Meyer. Halsted concluded that arm edema is the result of fibrosis following bad wound healing and is not related to the extent of the dissection. It is common knowledge that any insult to the lymphatics will produce lymphangitis and lymphatic obstruction, with a resultant accumulation of lymph fluid within the tissue space. The escape of the fluid is accompanied by fibrin formation and, if prolonged, by fibrosis. If this cycle is once initiated and unchecked, further and severe lymphedema will occur. Veal (14) concluded that 90 per cent of cases of postoperative lymphedema in his series could be attributed to metastatic blockage

of the venous system. Ten per cent of the patients had lymphatic obstruction on an inflammatory basis.

Holman (15), in a series of 100 cases, found no instance of venous blockage, nor were the axillary veins ligated in any of his cases. Lymphedema occurred in 70 per cent of this group. He believed that infection, either local at the operative site or distant, as in the hand, was an important contributing factor. Edema developed with equal frequency regardless of the condition of the axillary nodes. Swelling occurred both in cases receiving irradiation and in unirradiated cases.

Macdonald (16) believes that lymphatic obstruction secondary to perivenous lymphangitis and lymphangiectasis is the principal cause of postoperative lymphedema. He states that this complication will occur in 50 per cent of radically operated breasts.

Sampson Handley (17) felt that wound sepsis, attempted surgery in the presence of disease beyond the axillary lymphatic system, and most especially poor surgery are mainly responsible for postoperative elephantiasis. He observed that in 1 out of 6 cases of untreated cancer of the breast lymphatic edema of the ipsilateral arm will develop.

In summary, postoperative lymphedema is a distressing and often painful complication in the radical attack on carcinoma of the breast. The nature of its development is today still poorly understood. Irradiation is censured for it even though we are not told how the radiation was delivered, in what quantity, or the surgical details that preceded it. True, ionizing radiation, if too intensive and injudiciously applied, produces fibrosis, but embarrassment of the lymphatic system results from many other causes. To generalize from a specific instance is illogical. The literature and our experience, both in hospital or private practice, fail to support the thesis that postoperative roentgen therapy is the major cause of lymphedema.

One of us (18) has discussed elsewhere, at some length, the place of irradiation in the treatment of cancer of the breast. Irradiation is called palliative. We do not believe it is any more so than surgery. A so-called five-year surgical cure may in the sixth year be in the incurable group. The problem is not one of semantics, but what is best for the patient.

Other things being equal, we have advocated radical mastectomy and axillary dissection for surgically curable cancer of the breast. However, the patient cannot select her carcinoma, nor can the surgeon be certain of an axilla free of positive nodes.

There is indeed a substantial biological basis for the use of ionizing radiation in the treatment of cancer of the breast as for cancer elsewhere. The commonly described effects are mitotic, lethal, genetic, and the physiological effect of differentiation as described by Glücksmann (19).

It has been demonstrated histologically that mammary cancer in some cases can be sterilized, but there are intermediate stages. We do not believe that radiation in sufficient amount to sterilize the tumor is either desirable or necessary except in inoperable cases, or where there has been an incomplete surgical procedure. This suggests the advisability of preoperative irradiation, not with the idea of supplanting surgery but to complement it; nor with the idea that an inoperable cancer will be made operable, in the sense of curability, but solely in an endeavor to immobilize tumor cells of high malignancy in an attempt to improve the cure rate. The chief preoperative application of radiotherapy should be to modify the undifferentiated young neoplastic cells, as Coutard (20) recognized. This can be done with discerning amounts of radiation given within a reasonable time and without the production of fibrosis. Surgical intervention can then be instituted before the possible appearance of new young cells.

It is admitted that irradiation, if given in maximum doses, often locks the disease up in scar tissue as long as five or more years. Haagensen reports the case of a woman who refused operation in 1938 and received intensive roentgen therapy, with

disappearance of the breast tumor and axillary node. In 1944, there was a local recurrence, and in April of that year a radical mastectomy was done. In May 1949, there has been no further recurrence locally and no evidence of distant metastases.

Preoperative irradiation has been tried sporadically in this country, and inconclusively. Both radiation and surgery have come a long way since Greenough, in 1925, reported 130 cases of cancer of the breast in which long-wave x-ray therapy with a maximum of a 9-inch gap was given a few hours prior to operation. Our personal experience with this method is limited but we believe it has more of a place in the overall picture than has been given it.

In Europe, Westermark (21), in a small series, has reported a five-year survival of 40 per cent with preoperative irradiation, as against a 29 per cent figure where no prior irradiation was given. Cade (22) feels that it is to our advantage to irradiate preoperatively, particularly in advanced lesions. In his series, only 10 per cent of patients with Stage III disease survived with surgery alone, whereas with preoperative irradiation the five-year survival rate for this stage was 35 per cent.

Nohrman (23), in a clinical study of 1,042 cases treated at the Radiumhemmet, writes that, since it is impossible to determine with certainty from the clinical examination if a given case is an advanced one from the histologic point of view (metastases in several axillary lymph nodes and periglandular growth of cancer), preoperative irradiation should be given in all cancers of the breast.

Ash, Peters and Delarue (24) state that not only has the combination of surgery and high-voltage radiotherapy improved survival statistics, but they consider it of some importance that the incidence of local recurrence is also markedly lowered. Particularly was this true with the utilization of preoperative irradiation, where the local recurrence rate remained at a relatively low level of 12.3 per cent, despite the fact that better than 80 per cent of the patients so treated had advanced stages of local lesions.

Our experience has been confined to postoperative roentgen irradiation. This would not seem necessary or indicated in those patients in whom the disease has been shown by diagnostic roentgen, operative, and pathological examinations to be localized in the breast. However, such are unique. Simmons (25) has shown how fallacious is the clinical appraisal of the axilla. He reported 63 cases without palpable axillary disease, of which 33 were found on operation to have positive nodes, an error of 50 per cent. His experience is not singular. The pathological examination of the axillary contents may also be misleading. Saphir (26), studying serial sections of nodes previously examined microscopically and deemed negative, found 30 per cent to be malignant. Haagensen (27) continues to give postoperative radiation in patients with extensive axillary metastases.

Smith and Smith (28) reviewed 739 patients with previously untreated mammary cancer who came under the care of their hospital staff from 1905 to 1946. They make an important point. Roentgen irradiation was inadequate, according to present standards, until after 1930. Comparisons of results in their patients with axillary metastases, treated and untreated by x-rays, showed significantly higher survival rates in the treated at five and possibly ten years. Eighty-nine per cent of those who had received x-ray therapy had been operated upon after 1931, but critical analysis revealed nothing but irradiation to account for these better rates. These authors say it appears from their experience that primary irradiation is effective only in patients with cancer of high histologic malignancy, whether or not the axillary nodes are involved.

Because of the factual data presented and our own experience, we do not hesitate to treat breast cancer postoperatively. In uncomplicated cases, we have treated two portals only, the axilla and supraclavicular region. We do not irradiate the operated

chest wall because of the experience of one of us (29).

In an earlier paper (18) it was stated that, if routine postoperative irradiation is to be given in its commonly accepted sense of prophylaxis, then many more fields of irradiation should be utilized than is the prevailing custom, as has been suggested by Lenz (30) and others. It may not be sufficient to treat the affected chest wall, axilla, and supraclavicular chain of lymphatics; the mediastinum and parasternal nodes and lymphatics of the opposite breast must be treated as well, over a protracted period. This at once suggests an economic problem for the patient, as well as a therapeutic one with which surgeons and referring physicians should be familiar, so that patients will not present themselves for care on the basis that a few treatments will suffice.

Since the appearance of the work of R. S. Handley, the importance of a mediastinal portal or portals has loomed larger. It is curious that this area of metastasis has been so long neglected. W. Sampson Handley (31) called attention to what he described as "parasternal invasion of the thorax in breast cancer," in 1927, and reported his method of dealing with it by the insertion of radium tubes. He stated that he had evidence that radiation used as he outlined did destroy microscopic and even massive deposits in the internal mammary nodes.

If McWhirter's figures hold up, radiation therapists will have to adopt his method, when possible. Multimillion-volt therapy, radium and cobalt bombs, with or without rotation, have yet to prove their superiority. Meanwhile, there are patients to be treated who can avail themselves only of current conventional roentgen irradiation.

We here review 152 unselected cases of cancer of the breast, histologically verified and seen in radiological private practice between 1939 and 1946. This series includes all stages of the disease. Patients lost to follow-up, 21 in number, are considered dead with disease.

Ten cases were treated with roentgen rays in lieu of surgery: in 3 instances, the patients refused surgery; in 5 the disease was surgically incurable, albeit not surgically inoperable, and in 2 the physical condition of the patient prohibited major surgery. Five of this group, or 50 per cent, are living and well over five years. There were 3 patients who had axillary disease, 1 of whom survived. There were 4 without palpable axillary nodes, and all are living and well at five years, without demonstrable disease.

The radical operation was done in 142 cases. Radiation was delivered at 400 kv.p. with a special Thoraeus filter (h.v.l. 5.0 mm. Cu) at 50 cm. target-skin distance. The axilla and supraclavicular areas were treated successively through multiple portals of various size. Each portal received a total dose of 2,500 to 3,000 r, measured on the skin, in increments of 250 r every third day. If the lesion was advanced or inoperable, large field sizes were employed, the breast being treated through two tangential ports and the axilla through postero-anterior, anteroposterior, and direct ports. Four hundred kilovolt radiation was selected because of its shorter wavelength, which reduces the photoelectric effect, with less damage to the skin. A dry epidermitis is the rule.

When the lesion was superficial, as in a scar recurrence, 200 kv.p. with h.v.l. of 0.9 mm. Cu was used. The total air dose of about 2,000 r was delivered, when necessary. When it was a question of relieving bone pain, a smaller total dose, between 800 and 1,000 r, was given. All patients were placed on a regime of supplementary vitamins. It is our experience that patients better tolerate roentgen therapy when bolstered in this manner.

The average age of the patients, when first seen in the office, was 43.5 years. The youngest was twenty-eight and the oldest was eighty-six. The greatest morbidity and mortality occurred in the younger age group. This is in agreement with the experience of others.

The average interval between surgery

and the time of referral was 12.2 weeks. The shortest elapsed time was two weeks and the longest was three years. It is our experience that those patients who are seen within a month of the surgical procedure do better than those referred late in the postoperative phase. This is in agreement with Pfahler (32). There are some reluctant to refer cases too early after surgery on the ground that radiation would interfere with wound healing. Jüngling, (33), who has presented an excellent review of this subject, and other workers are not able to support the thesis of impaired cicatrization.

Twenty-seven patients in our series had recurrent disease, an incidence of 19 per cent. The average time of appearance of the recurrent lesion was eight years; the shortest interval was three weeks, and the longest was twenty-eight years. In 16, or 59 per cent of these cases, recurrence was manifest within three years. It was in the scar 7 times and in the axilla and skin 10 times each.

There were 18 cases of metastases in the skeleton, 11 in the lung and pleura, 6 in the supraclavicular area, and 1 each in the brain and scalp. The average time of appearance was 3.3 years. The shortest interval was eight months and the longest ten years. In the majority of cases, the skeletal lesions occurred within the first three postoperative years.

Of our 152 patients, including those lost to follow-up, 58 (38+ per cent) are living and well without demonstrable disease at the end of five years. If we exclude the 21 lost to follow-up, this figure changes to a net survival of 44 per cent.

Of the 36 patients known to have had positive axillary nodes, 22 (60 per cent) are living without demonstrable disease. Of those known to be free of axillary disease, 75 per cent are living and well at five years.

Of the 25 patients with recurrent carcinoma of the breast, 11 (44 per cent) responded favorably to a single course of x-ray treatment. Eight (32 per cent) required more than one seance. Six patients failed to improve. It is noteworthy that in 2 patients the recurrent lesions had been surgically excised three different times without relief. It is our experience, as well as Martin's (34), that irradiation is the treatment of choice in the management of recurrent breast cancer.

Almost without exception, radiation was the only agent short of opiates successful in the control of pain due to skeletal implants. Treatment in these cases was purely symptomatic. Irradiation of supraclavicular metastatic disease was highly successful. Osteolytic metastases are seen to "fill in."

The hormones proved beneficial in isolated cases. The male hormone seemed to offer some relief of bone pain and, at times, to cause recalcification. The female hormone was occasionally useful in soft-tissue and pulmonary metastases in elderly patients. One effect of these agents is the feeling of well-being experienced by many. The side-effects are well known and need not be discussed here. The definitive place of these agents in breast cancer therapy has not been determined.

The group we have reported is small statistically, but we believe adequate. We are not unaware of Lang's comment that statistics are commonly used as a drunk man uses a lamp post, which is to say for support rather than for illumination; nor of Belloc's that, if one of two walking along the seashore were killed by lightning, the other would be 50 per cent dead. Really to evaluate statistical studies, provided certain scientific criteria are to be applied, would take the greater part of the lifetime of a group making comparative studies under conditions almost impossible to reproduce. We go along with Hopkins (35) that, until such time as investigators are able to arrive at a conclusion acceptable by scientific standards, the clinician faced with immediate responsibility of deciding on a course of action will continue to do what he feels is best in view of the weight of the evidence as he sees it.

To present our personal experience with contemporary radiation therapy in breast

cancer seems important before concluding this paper. One of us (F. W. O'B., Jr.) has had the privilege of making a preliminary report on a group of patients from the Lahey Clinic treated at the Massachusetts Institute of Technology after the fashion outlined by Hare, Trump, and Webster (36). Two methods of rotation have been used, so-called type A, where the beam enters medially and anteriorly and progresses to a postaxillary portal laterally, and type B, where it enters a postaxillary portal posteriorly and progresses to a mediastinal portal anteriorly. The reputed advantages of a scanning technic are the skin-favoring properties of 2 mev radiation and the ability to deliver a substantially uniform dose over a region extending from the axilla to the mediastinum, bounded by the pleura on the inside and the subcutaneous tissues on the outside, with only two treatment fields.

An attempt is made to deliver a depth dose of 6,000 r. Appropriate lung, larynx, and shoulder blocks are used. Radial or step filters are employed to produce a beam of uniform intensity throughout the treated regions. The breast portals are about 23 × 15 cm. The field is set up and the patient is rotated from behind forward, about 180 degrees, then from in front backward for the same distance.

Twenty-six patients with carcinoma of the breast were treated with the scanning technic at the Massachusetts Institute of Technology between Nov. 15, 1949, and Nov. 18, 1952. Of these, 10 are living, 8 are dead, and 8 are lost to follow-up. Seventeen patients had prior surgery. Of these, 8 are living, 7 are dead, and 2 lost to follow-up. Of the 9 patients who had no surgery, only 1 is living. The longest follow-up is three years and four months. Of the living patients, 2 at least are known to have disease. One patient has survived for over three years, 3 for two years and a half, and the remaining 5 for a year to the date of their last follow-up. One is at once impressed by the fact that there are more living who were treated surgically than without surgery.

One striking feature of the scanning method is the freedom from pulmonary fibrosis. We have seen fibrosis of the lung and subcutaneous tissue when direct portals have been employed.

Certain observations appear pertinent. Many of the patients were hopeless when referred for irradiation. We feel that if there is to be any comparison between the lower-voltage and the multimillion-volt range, earlier cases must be referred for the latter type of therapy.

Whatever the method, we may conclude with Smithers *et al.* (12) that the value of radiotherapy is established. It is known to be capable of eradicating the disease in some cases and of restraining growth in others, sometimes for long periods. Its close association with surgery, which it may support before or after operation in a carefully planned combined treatment, demands surgical-radiotherapy consultation before, during, and after the first planned treatment in every case, if the patient is to be offered the best chance available.

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SUMARIO

La Cirugía y la Irradiación en el Cáncer de la Mama Femenina

Un repaso de la literatura indica que se ha rebajado exageradamente el valor de la irradiación en el cáncer mamario. Lo observado por los AA. y por otros no presta apoyo a la opinión, expresada algunas veces, de que la roentgenoterapia representa una causa principal del linfedema vinculado con el cáncer de la mama.

Discútese aquí la radioterapia tanto preoperatoria como postoperatoria. Han comunicado otros resultados favorables obtenidos con la irradiación preoperatoria. Las observaciones de los AA. se limitan a la postoperatoria. Repasan ahora 152 casos, comprendiendo todos los períodos de la dolencia, observados en su práctica radiológica entre 1939 y 1946. Veintisiete enfermas de la serie experimentaron recurrencias en la cicatriz o la axila o la piel; 18 tuvieron metástasis óseas; 11 metástasis pulmonares y pleurales; 6 en la zona supraclavicular y 1, cada uno, en el cerebro y el cuero cabelludo.

De 10 enfermas que no recibieron más que roentgenoterapia, 50 por ciento se hallaban vivas y sanas al cabo de cinco años, comprendiendo una con invasión de los ganglios axilares. En 142 enfermas, se practicó la mastectomía radical, con irradiación postoperatoria a 400 kv. a las zonas

axilar y supraclavicular. De toda la serie (comprendiendo como fallecidas a las perdidas de vista), 58, o sea 37 por ciento, estaban vivas sin enfermedad observable al cabo de cinco años. De 36 pacientes que se sabía tenían invasión de los ganglios axilares, 22, o sea 60 por ciento, estaban vivas y sanas; en aquéllas sin afección axilar, la proporción era de 75 por ciento.

De 25 enfermas con lesiones recurrentes, 19 revelaron mejoría después de una o más series de tratamiento. Seis no mejoraron.

Menciónanse los resultados de los últimos procedimientos de irradiación—notablemente la" técnica escrutadora"—,deduciéndose que, independientemente de método, está ya establecido el valor de la radioterapia en el carcinoma mamario, sabiéndose que es capaz de erradicar la enfermedad en algunos casos y de contener la proliferación en otros, a veces durante períodos prolongados de tiempo. La combinación de la misma con la cirugía requiere en todos los casos consulta entre el cirujano y el radioterapeuta antes de emprender el tratamiento.

DISCUSSION

James C. Cook, M.D. (Detroit, Mich.): The authors should be highly complimented upon an excellent and timely review of the current literature dealing with the treatment of cancer of the breast. The conclusion that the pendulum is swinging away from more radical surgery to a more conservative type of overall treatment including, in many cases, preoperative and postoperative roentgen therapy, is one that is entirely justifiable. It is almost impossible to find a recent article from one of the major centers, appearing in a medical journal, which does not show a shift to a more conservative approach.

I could not help noting that Dr. Ash of Toronto advised preoperative radiation therapy in all but Stage I and II cases; and in a recent article appearing in the *British Medical Journal*, Williams, Morley and Curwen, from St. Bartholomew's Hospital, London, recommended that where efficient radiation therapy is available radical mastectomy should be abandoned in favor of conservative surgery.

In dealing with such a treacherous disease as breast carcinoma, it is doubtful whether the most radical surgery and the most intensive radiation therapy can accomplish all that would be desirable. Prevention of eventual recurrence except in the earliest cases seems nearly impossible. Most investigators now accept the idea that the most efficient treatment in cancer of the breast is the one which leads to longest remission with the least disability of the patient.

The authors also call attention to the recent widespread recognition of the internal mammary lymph node chain as a source of early metastases. In this connection, it is interesting to note that Dr. Low-Beer of San Francisco, in addition to conventional radiation therapy, is administering moderate and well controlled doses of radioactive phosphorus in an attempt to eradicate, if possible, the small malignant foci.

The high survival rate in the series presented here today attests the careful attention that was given these cases by the radiologist. It is noteworthy that many of these patients were treated with 400-kv. radiation. There are only very few reports in the literature dealing with this type of therapy in breast cancer. Such treatment admittedly produces a more homogeneous irradiation of the tumor with less damage to the overlying skin and should bring about tumor control in a more efficient manner. The material presented adds valuable information on this important subject.

The use of roentgen therapy in the two-million-volt range and the even more modern technics of scanning and rotation represent still further progress along similar lines. Determination of the advantages of these methods, however, remains, as the authors rightfully state, a problem for the future.

A. F. Rocco, M.D. (New York, N. Y.): At our hospital—the Francis Delafield, in New York—in addition to the triple biopsy which is being performed by Dr. Haagensen and his staff, iliac marrow biopsies have also been done in the past year with the punch system. We all know that cancer of the breast frequently metastasizes to the bones of the pelvis and, although the series is quite small, in approximately one-third of the cases the biopsies have been positive in the absence of other evidence of bone metastasis. This suggests another addition to preoperative criteria for the future.

Dr. F. W. O'Brien, Jr. (*closing*): I would like to thank Dr. Cook very much for his discussion of our paper. I don't think I have anything more in the way of information to add except that I have had a little experience with supervoltage and I think the most important part of the work is to observe whether or not the incidence of local recurrence is going to diminish. If it does, than perhaps we may have something, but I am not so sure that we have to give as much by way of dosage as we sometimes give.

I am much interested in Dr. Rocco's remarks. I will certainly look forward to the literature to see what develops.

Dosage Determination for Rotation Therapy in the Horizontal Plane[1]

EDITH H. QUIMBY, Sc.D., VICTORIA CASTRO, B.A., and CHARLES SOIFER, B.A.[2]

IN ONE ASPECT of moving-field x-ray therapy, the beam may be made to go completely or partially around the body, either by rotating the patient around an axis perpendicular to the axis of the beam or by moving the x-ray tube on the circumference of a circle centered on an axis through the patient. This may be described as "vertical" or "perpendicular" or "long-axis" rotation; the method has been employed by a considerable number of radiologists, and dosage calculations are fairly straightforward (1). In another procedure, the patient (usually in a recumbent position) is rotated about an axis at an angle to the beam, or the beam describes a circular path over one surface of the patient. This is usually designated "horizontal" or "short-axis" rotation therapy.

Each of these methods is advantageous in certain types of case. By means of long-axis rotation, small deep-seated lesions can be given high doses, while surrounding tissues and skin are spared. The method is applicable to either spherical lesions or elongated ones such as those in the esophagus. Short-axis rotation is more useful for lesions considerably closer to one surface of the body, although deeper ones may be treated by two rotation setups cross-firing from opposite sides of the

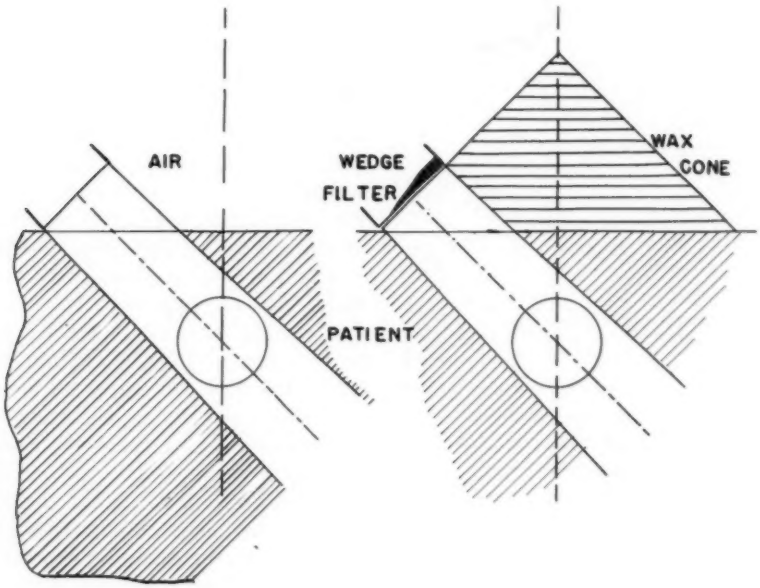

Fig. 1. Diagrams illustrating use of wax cone and wedge filter in equalizing radiation throughout a lesion when a tilted beam is employed.

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[2] From the Department of Radiology of the College of Physicians and Surgeons of Columbia University, New York, N. Y.

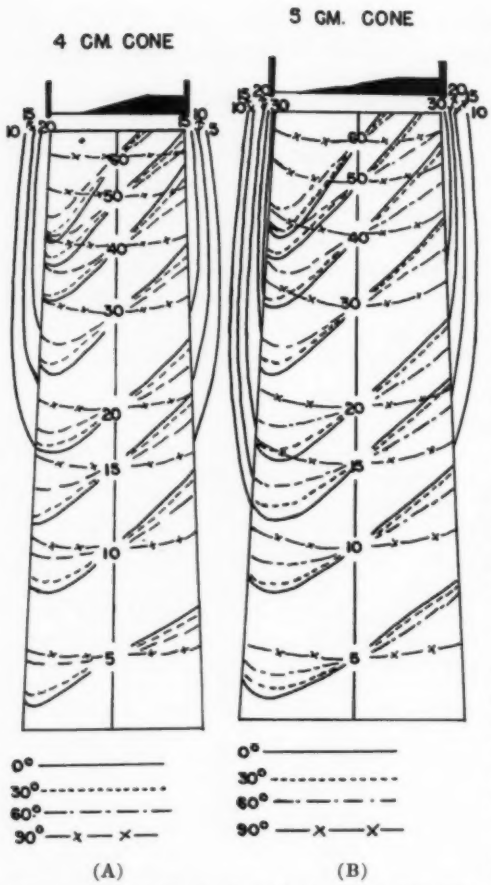


Fig. 2. A and B. Isodose charts in 0°, 30°, 60°, and 90° planes, for 45° wedge filters. X-rays at 250 kv.p., h.v.l. 1.8 mm. Cu, target-skin distance 50 cm. Circular beams, diameters 4 and 5 cm. Half actual size. Dose per 100 r in air at end of treatment cone, without wedge filter.

body. It is usually suitable only for spherical or relatively flat lesions.

The matter of dosage determination for horizontal rotation therapy has been well analyzed by Green, Jennings, and Bush (2). For the basic calculations reported in this paper, their method has been followed, with some modifications (see Appendix III). For approximate calculations, however, simpler methods have been developed, in order to permit rapid decision as to the applicability of the procedure in any special case.

The problems involved in developing dosage determination methods arise from variations in dose due to the oblique passage of the beam through the body. This is evident from consideration of an instantaneous position in this type of therapy, as shown at the left in Figure 1. The tilted beam obviously delivers a considerably higher dose of radiation in the upper part of the lesion, both because this is nearer the target than the lower part, and because the x-rays reaching this region have traversed more air and less tissue than those going to the lower portions. Jennings has pointed out that the inequality due to the air space can be eliminated by interposing a wax cone, as shown on the right in the figure; this furthermore provides a nearly flat surface perpendicular to the beam direction, so that normal static isodose charts are immediately applicable. The target-distance factor can be corrected by the use of a wedge filter, as indicated.

When a circular field is used without a wedge filter, isodose surfaces are always symmetrical about the central axis of the beam; hence, all longitudinal sections of the beam show the same isodose diagram. If a wedge filter is used, there will be a different isodose chart for every angle between the plane of the chart and a fixed plane through the wedge. When the plane of the isodose chart is in such a position that the wedge exerts its maximum effect, the curves will be most asymmetrical, the dose being greatly reduced on the high side of the wedge (Fig. 2). At right angles to this position, the plane of the isodose chart passes through the mid-thickness of the wedge and the curves are symmetrical. For all intermediate positions, the tilts of the isodose lines are intermediate between these extremes. As a patient is rotated in a tilted beam, without a wedge filter, the isodose chart is the same for all positions. But when the wedge filter is in place, points in the body fall continuously into different isodose planes; accordingly it is necessary to have a series of isodose charts for different angles.

In planning therapy of this type, the field chosen will be one which will completely cover the tumor-bearing volume.

Theoretically, for any particular depth of a lesion of a particular size, there is an optimum geometrical arrangement—tilt of beam and radius of wax cone. For every angle of tilt a corresponding wedge filter is desirable to obtain the best radiation distribution. Furthermore, for each angle, the wax cone must be constructed with the correct slope.

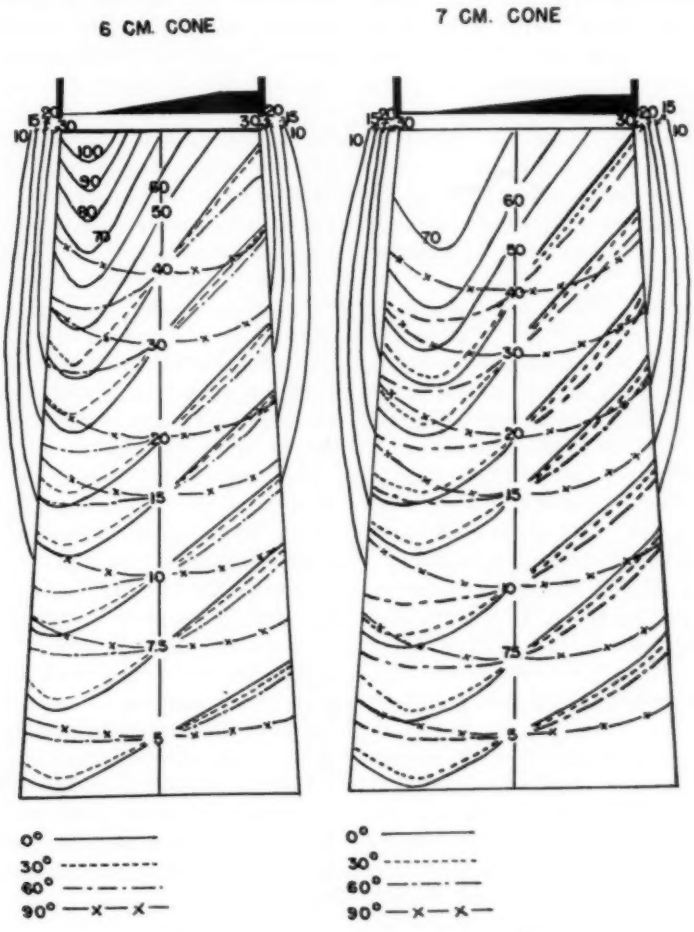


Fig. 2. C and D. Isodose charts in 0°, 30°, 60°, and 90° planes, for 45° wedge filters. X-rays at 250 kv.p., h.v.l. 1.8 mm. Cu, target-skin distance 50 cm. Circular beams, diameters 6 and 7 cm. Half actual size. Dose per 100 r in air at end of treatment cone, without wedge filter.

PLAN OF STUDY

The plan of the work presented here was (*a*) to select certain beams and angles of tilt which appeared most applicable to clinical problems, and to construct suitable wedge filters; (*b*) to make depth dose measurements for the development of isodose charts in various planes through the wedges, and also for the beams without wedge filter; (*c*) to calculate doses from these, for a number of points continuously or intermittently in the beam; (*d*) to measure doses for the same points, during rotation of the phantom; (*e*) to attempt

to develop simplified procedures for approximate dosage calculation to permit rapid evaluation of the method in a particular case.

EXPERIMENTAL PROCEDURE

The x-rays employed in the study were generated at 250 kv.p., with a h.v.l. of 1.8 mm. Cu; the target-skin distance was 50 cm. Effects of variations in these factors will be considered below. Beams ranged from 4 to 7 cm. in diameter. Smaller beams have few applications in this type of therapy because of localization problems; larger ones generally involve heavy irradiation of too large a segment of the body.

The only wedge filters thus far constructed are for a tilt of 45°. These are serviceable for angles between 38° and 55°, and it appears at present that this range will cover most of the practical problems. Beams entering the body more steeply are likely to cross at or above the body surface, with resultant high skin doses. Protection of the "hot" spot by lead insets is possible; dosage calculations then become very complicated. With beams entering the body more obliquely, the tumor lies in low dose regions in the isodose chart, the irradiation time becomes unduly prolonged, and other treatment plans are likely to be preferable.

Various types of wedge filters were considered, and it was decided to use the "high-output, plateau type filter" described by Groom (3). A special wedge has to be constructed for each field, but the formula is simple to apply (see Appendix I), and the wedges are easily assembled from thin sheets of metal or made in the machine shop.

The construction of the corresponding wax cone is described in Appendix II.

Data for construction of isodose charts were obtained with a unit-density presdwood phantom and 14 Baldwin-Farmer intracavitary ionization chambers, the latter carefully calibrated for the quality of radiation employed, by comparison with a recently standardized Victoreen chamber. Comparisons were made for various radiation doses and at various depths within the phantom.

Isodose charts were constructed in the plane in which the wedge exerted its maximum effect (called the 0° plane), the plane perpendicular to this, passing through the mid-thickness of the wedge (the 90° plane), and two intermediate planes at 30° and 60°. These were the angles employed by Green, Jennings, and Bush in their basic work. They used a different type of wedge (mathematically better, but producing a much greater reduction in radiation output), and these angles gave good distribution of their isodose curves. Isodose charts for the current wedges, for fields 4, 5, 6, and 7 cm. in diameter, are presented in Figure 2 in exactly half size. The distribution of the curves might have been improved by trying other directions through the wedge. This series, however, works well in practice.

All isodose charts were plotted in terms of the tissue dose in roentgens per 100 roentgens in air at the end of the treatment cone, without the wedge filter.

The phantom was then mounted on an electrically driven rotating table. For each treatment cone, with no wedge or with a suitable 45° wedge, and the correct wax cone for irradiation of a chosen region, the Baldwin-Farmer chambers were distributed at determined points within the phantom. Readings were taken for definite periods of rotation, and the doses at various points were determined per 100 roentgens in air at the end of the treatment cone, without wedge filter.

CALCULATION OF DOSAGE

The method for definitive calculation of average dose rate in this type of therapy has been analyzed and described in detail by Green, Jennings, and Bush in the article previously referred to. It is mathematically laborious, particularly when the wedge filter is used. A step-by-step outline of the procedure is given in Appendix III. By this method, doses were calculated at all points for which measurements had

been made, and many others, both inside and outside the continuously irradiated volume, for cones of 4, 5, and 6 cm. diameter, with various circles of rotation defined by appropriate wax cones, with and without the 45° wedges. The calculated values were then checked by the use of the Baldwin-Farmer chambers in the continuously rotating phantom. In general, the more accurate calculations could be made for critical points, if desired. Accordingly, a method of approximate dosage calculation was developed.

By reference to Figure 3, certain points are immediately evident. AA represents the skin surface, flattened by the application of a horizontal plate under mild pressure. (A sheet of Lucite attached to the

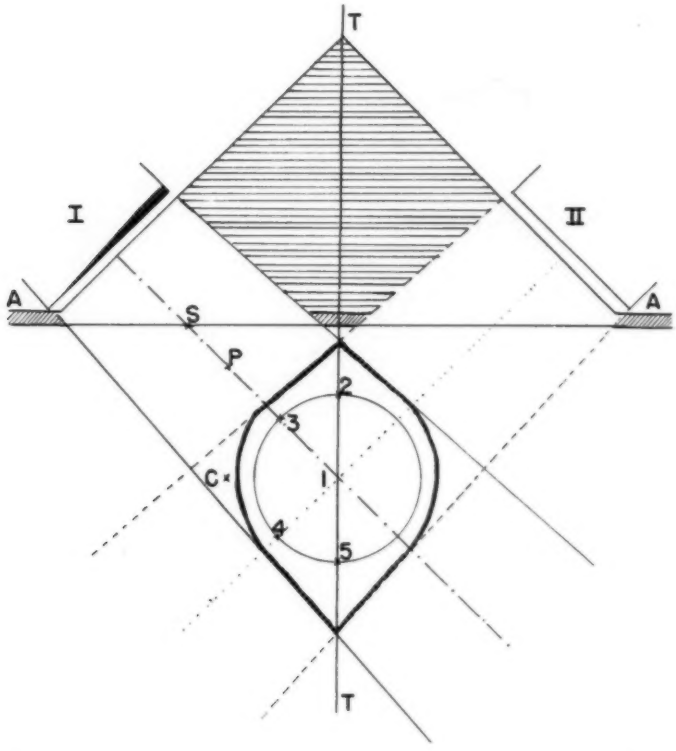


Fig. 3. Diagram showing regions of continuous and partial irradiation in horizontal rotation set-up.

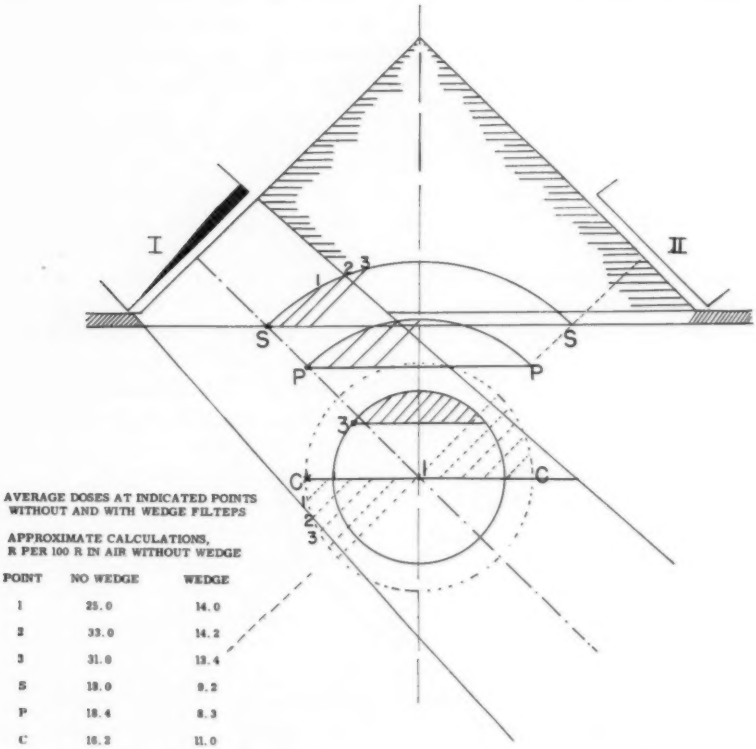
checks were excellent, as will be demonstrated below.

For practical purposes, an accurate knowledge of dose to be delivered at the center of the irradiated volume and a good approximation of doses at other points would be valuable. By means of this data, the radiologist could decide the suitability of a particular cone and angle arrangement for a particular case. Later, when the preliminary set-up was approved, treatment table, as described by Jennings (loc. cit.) is excellent for this purpose. (Space between this plate and the body is to be filled in with bolus if necessary.) The circle represents a spherical tumor 6 cm. in diameter, the center of which is 6 cm. beneath the skin. TT is the axis of rotation of the treatment table; the patient is placed with the center of the tumor on this axis. A 6-cm. circular beam covers the mass satisfactorily; for a 45° angle the

diameter of the base of the wax cone will be 20 cm. The beam occupies the position indicated by the heavy outline I, with the wedge filter in the position shown (if it is employed). The central axis of the beam passes through the center of the tumor, intersecting the axis of rotation at that point. (Correct positioning of the axis of rotation, the axis of the beam, and the wax cone, are critical. Methods for this are not discussed here.) The dotted beam outline II indicates the position of the beam relative to the patient after a half-rotation, although in fact it is, of course, the patient who has moved, and not the beam.

The region of continuous irradiation is shown by the heavy black line enclosing a region bounded at top and bottom by beam edges, and laterally by circles tangent to these. All points within this region are irradiated throughout the exposure. Other points are directly irradiated only a part of the time or not at all.

If now the proper isodose chart is superimposed over the beam outline, it is evident that, while the body turns on axis TT, the beam maintaining its steady position, all points on this axis TT, such as 1, 2, and 5, remain in exactly the same place in the beam throughout the rotation. Hence the dose at any one of these points is accurately read directly from the superimposed isodose chart. When no wedge filter is used, there is no choice of isodose curves. With the wedge, the curve to be employed is that for the 0° position, since this is the one on which the axis constantly lies. Since the isodose charts are constructed in roentgens at any point per 100 roentgens in air at the end of the treatment cone, without the wedge, the



AVERAGE DOSES AT INDICATED POINTS WITHOUT AND WITH WEDGE FILTERS

APPROXIMATE CALCULATIONS, R PER 100 R IN AIR WITHOUT WEDGE

POINT	NO WEDGE	WEDGE
1	25.0	14.0
2	33.0	14.2
3	31.0	13.4
5	19.0	9.2
P	18.4	8.3
C	16.2	11.0

Fig. 4. Diagram for determination of approximate dose at various points.

tissue dose is directly correlated with the air dose, for each of these points.

Points such as 3 and 4 are continuously irradiated, but at differing rates as the body turns in the beam. The skin and such points as P and C receive direct radiation during only part of the rotation. With accurate knowledge of doses at the points on the axis of rotation, an approximate idea of their relation to doses at other points both inside and outside the continually irradiated region will offer a good basis for treatment planning.

The method of approximation depends on whether or not a wedge filter is used. Furthermore, variations arise according to whether the point is always in the beam, in the beam during only part of the irradiation, or never in the direct beam. The approach to all these may well be presented in a summary form.

In all instances the first step is to construct a cross-section diagram in actual size, indicating exact positions of tumor, skin, beam and beam axis, and axis of rotation. This may be done, as in Figure 4, on centimeter-squared paper, for facility in measurement of angles and distances.

Dosage Approximation Summary[3]

A. Without wedge filter
  1. Points always in beam (direct radiation continually).
    (*a*) On axis of rotation. Read dose directly from isodose chart placed in Position I.
    (*b*) Not on axis. Place isodose chart in Position I, read dose at point; move chart to Position II and read dose. The average of the two values is the dose in question.
  2. Points never in beam (scattered radiation only).
    (*a*) Deeper than continually irradiated region. Dose is always less than one-third that at center of rotation.
    (*b*) Outside both beams laterally. Dose is always less than one-third that at center of rotation.
    (*c*) Between two beams, close to skin. Dose may be as much as that at center of rotation, but will usually be less.
  3. Points partially in beam (some direct radiation).
    (*a*) Beyond continually irradiated region. Dose never more than half that at center of rotation.
    (*b*) Closer to surface than continually irradiated. (This includes skin.) For this situation a calculation must be made.[4] On the cross-section of Figure 4 the necessary geometrical construction for several points has been made: S, on the skin at the point of entrance of the beam axis; P, on the beam axis about half way between the skin and the tumor; 3, in the continuously irradiated region; C, outside this and below the axis of the beam. Through each one of these a line is drawn parallel to the skin surface. Through each one, also, an arc of a circle is described, with the center at the point of intersection of the beam axis and the axis of rotation (SS, PP, CC). The horizontal chord subtending the arc (chords SS, PP, CC) is divided into ten or twenty equal parts. For points which are only in the beam during a small part of the rotation, especially those on the skin, twenty divisions should be used. Through each point of division a line is drawn perpendicular to the axis of the beam, extending out to cut the arc pertaining to that chord. (Use of a right triangle to construct these perpendiculars is sufficiently ac-

[3] Agreement between approximately calculated doses, those accurately calculated, and those measured, will be discussed below.

[4] The method here presented is applicable to all points, if the approximations listed above are not satisfactory.

TABLE I: FACTORS FOR INTERVALS DURING ROTATION

Interval	Chord Divided in 10 Segments	Interval	Chord Divided in 20 Segments
1	0.205	1	0.143
		2	0.062
2	0.090	3	0.048
		4	0.042
3	0.074	5	0.038
		6	0.036
4	0.067	7	0.034
		8	0.033
5	0.064	9	0.032
		10	0.032
6	0.064	11	0.032
		12	0.032
7	0.067	13	0.033
		14	0.034
8	0.074	15	0.036
		16	0.038
9	0.090	17	0.042
		18	0.048
10	0.205	19	0.062
		20	0.143

curate.) The intercepts of the perpendiculars with the arcs are numbered, number 1 being the intercept closest to the beam axis, etc. Factors will be associated with these segments as given in Table I.[5]

Now with the diagram on a lightbox, the isodose chart is superimposed so that its outline coincides with its position in the diagram. For each point, the number of the first segment which lies partly outside the beam is noted. This is called the number of segments in the beam. To calculate the dose, the reading from the isodose chart is taken, *not for the point itself, but for the position of the termination of the central segment lying within the beam.* For example, if two segments lie within the beam, the reading is taken at the point where the boundary of the first cuts the construction arc. (End of segment 1, for point S, Fig. 4.) This reading, multiplied by the sum of the factors for the number of segments in the beam, from Table I, gives the approximate dose at the point, in roentgens per 100 roentgens in air at the end of the treatment cone. However, in case the point is in the beam for only a small part of the rotation, the contribution of scattered radiation from outside the beam will be an appreciable part of the dose. In order to make an approximate allowance for this, one additional segment factor is included when less than 3 segments are effective. The data for the three points on Figure 4 are collected in Table II.

TABLE II: DOSAGE CALCULATIONS FOR POINTS ON FIGURE 4; NO WEDGE FILTER

Point	Segments in Beam	Isodose Reading for End of Central Segment	Factor for Sum of Segments	Dose r/100 r Air
S	First 2 (of 20)	70	0.205; add one 0.253	18
P	First 3 (of 10)	50	0.369	18.4
C	First 3 (of 10) and Last 3	29 + 15 = 44	0.369	16.2

B. With wedge filter

1. Points always in beam.

(*a*) On axis of rotation. Read dose direct from isodose chart for 0° angle.

(*b*) Not on axis. Place isodose chart in Position I, take readings for point in question *from all four curves. Reverse the chart* and place in Position II. (The need for this reversal will be evident if the path of the point during rotation is visualized.) Take a second set of readings for all

[5] The basis for derivation of these factors will be found in Appendix III.

TABLE III: DOSAGE CALCULATIONS FOR POINTS ON FIGURE 4 USING WEDGE FILTER

Point	Segments in Beam	Isodose Readings	Factor for Sum of Segments	Dose r/100 r Air
		0°, 30°, 60°, 90°		
S	First 2 (of 20)	32, 33, 35, 45 Average 36	0.205 Add one = 0.253	9.2
P	First 3 (of 10)	20, 20, 21, 29 Average 22.5	0.369	8.3
C	First 3 (of 10)	28, 27, 21, 17 Average 23	For each set 0.369	
	and Last 3	7, 7, 7, 9 Average 7.5 Sum 30.5		11

It should be noted that when the point falls below the central axis of the beam, during the first half of the rotation, the segments should be marked off on the lower arc of the circle, as indicated for point C. During the second half of the rotation the point will lie above the axis, and the upper arc is to be used.

four curves. The average of the eight values is the approximate dose at the point per 100 r in air at the end of the treatment cone.

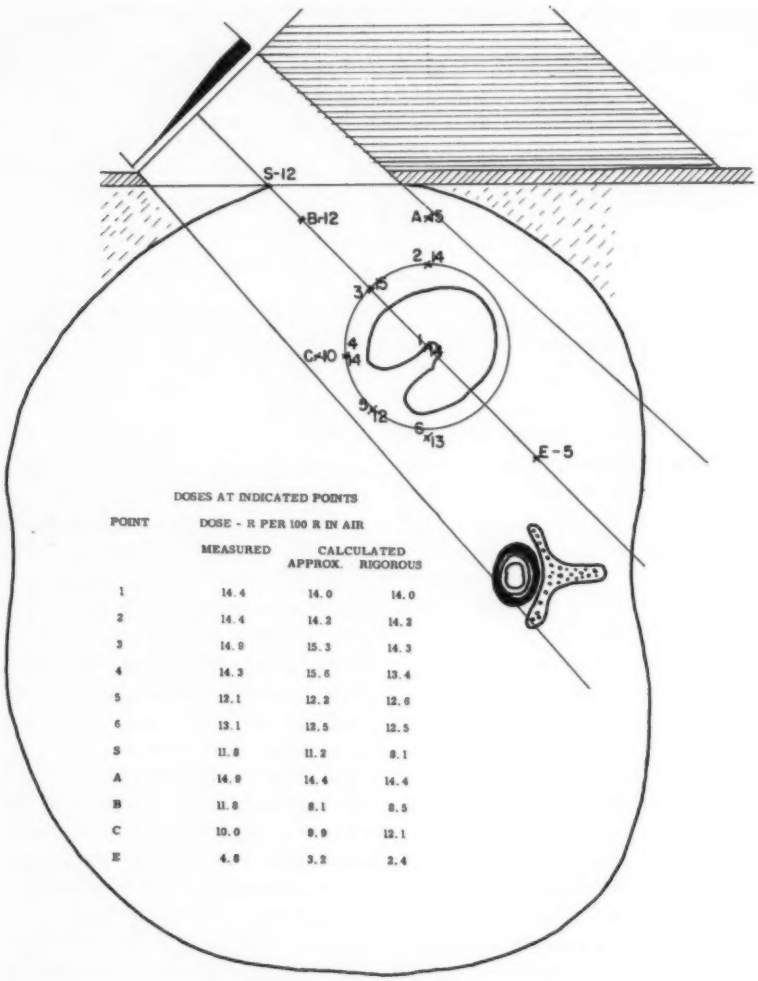
2. Points never in beam. The same statements hold as for the case without wedge filters.
3. Points partially in beam.
   (*a*) Beyond continually irradiated region. The same conclusion holds as for the similar case without wedge filters.
   (*b*) Closer to surface than continually irradiated. In this situation the same construction is made as for the like situation without wedge filter. The same procedure is followed of determining the position of the terminal point of the central segment. Readings are taken for this point for all four isodose curves, and the average is taken. This average is multiplied by the appropriate factor from Table I; the result is the approximate dose for the point in question. The same extra segment allowance is made as in part A, when less than 3 segments are effective.

Calculations for certain points in Figure 4, when the wedge filter is used, are given in Table III.

RESULTS

The agreement of values calculated by the rigorous method and the approximate method and those experimentally determined is shown in Figures 5, 6, and 7, for three specific treatment plans. Specifications for each plan are given in the appropriate figure legend; the first might serve for a kidney lesion, the second for a tonsil, and the third for the external auditory canal. In each case, the 0.5-cm. Lucite flattening disk covers the skin, and the space between this and the body is assumed to be filled with bolus. A clearance of about 3 mm. is allowed between the wax cone and the end of the treatment cone. In the last case (Fig. 7), where the lesion extends to the body surface, it is made deeper artificially by placing 1 cm. of unit density material between the skin and the defining Lucite disk. Any superficial lesion can be "submerged" in this manner if desirable. A somewhat similar situation exists in the "tonsil" set-up (Fig. 6). Here, owing to the shape of the head, the skin at the center of the entrance portal is 1 cm. deep in bolus.

A comparison of measured and calculated values shows that, on the whole, agreement is good. Except for the skin and the points near it, differences are of the order of less than 10 per cent. For points in the beam only a small part of the time, calculated values are low, probably because sufficient allowance is not made for off-beam scattered radiation. In the approx-



DOSES AT INDICATED POINTS

POINT	DOSE - R PER 100 R IN AIR		
	MEASURED	CALCULATED APPROX.	CALCULATED RIGOROUS
1	14.4	14.0	14.0
2	14.4	14.2	14.2
3	14.9	15.3	14.3
4	14.3	15.6	13.4
5	12.1	12.2	12.6
6	13.1	12.5	12.5
S	11.8	11.2	8.1
A	14.9	14.4	14.4
B	11.8	8.1	8.5
C	10.0	9.9	12.1
E	4.8	3.2	2.4

Fig. 5. Treatment plan for 6-cm. beam angled at 45°, using wedge filter. 250 kv.p., h.v.l. 1.8 mm Cu, 50 cm. target-skin distance, radius of wax cone 21 cm. Numbers on diagram indicate measured doses in roentgens per 100 roentgens in air at end of treatment cone, without wedge filter. Inset table compares measured doses with those calculated by approximate and rigorous methods.

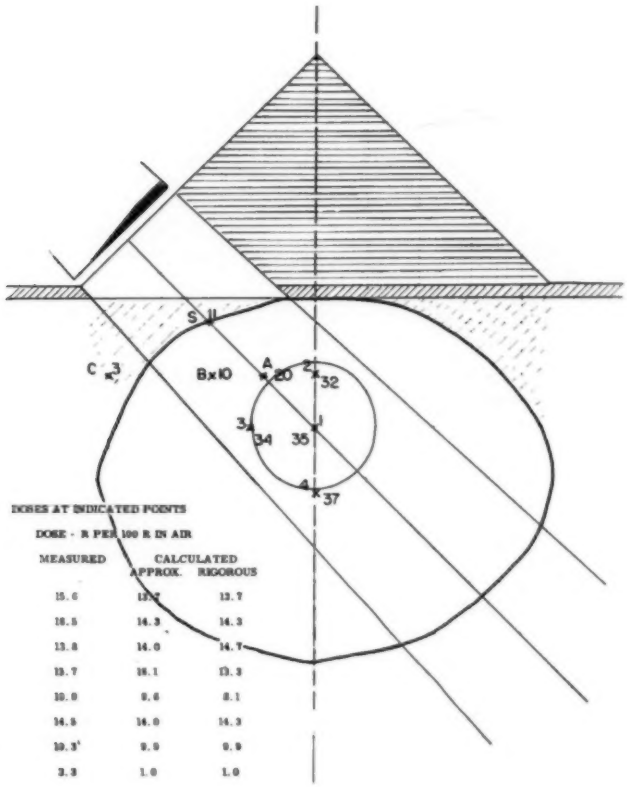
imate calculation method an arbitrary correction factor has been introduced to compensate for this. The homogeneity of dose throughout the continuously irradiated region and the lower values outside this are satisfactorily checked.

Great exactness is necessary in centering the lesion in the axis of rotation and in the axis of the beam, and in establishing the angle correctly. A very slight shift may badly distort the homogeneity of the irradiation. Accurate setting-up is relatively simple with the rotating phantom; it is much more difficult with the patient. The writers have done no work on this phase of the problem. Green gives some valuable suggestions for special cases.

CHOICE OF PHYSICAL FACTORS FOR THE RADIATION

As stated earlier, all work discussed here was done with x-rays generated at 250

kv.p. with h.v.l. 1.8 mm. Cu, at a target-skin distance of 50 cm. The statement is sometimes made that in rotation therapy it it not as important to employ long distances and well filtered beams as when fixed ports are used. This has been interpreted to mean that these factors may be more or less disregarded, especially since most of the presently available information in the literature is based on shorter distances and softer radiation. The error of this conclusion is evident from Figure 8, showing dose distribution for the same lesion treated with two qualities of radiation and slightly different distances, no wedge filters being used. Homogeneity is much better with the harder beam. Furthermore, the ratio of skin dose to mid-tumor dose is much less favorable for the softer radiation. The time necessary to deliver a specified tumor dose depends, of course, on the applied kilovoltage. Operating at the factors specified above, the machine employed at the Presbyterian Hospital for treatments of the type under discussion has an output of about 60 r per minute in air at 50 cm. It is thus possible to deliver a daily tumor dose of 170 r to the center of the mass in Figure 8 (25 per cent of r in air at end of cone) in about eleven minutes. During this time the skin receives 85 r.



DOSES AT INDICATED POINTS

POINT	DOSE - R PER 100 R IN AIR		
	MEASURED	CALCULATED APPROX.	CALCULATED RIGOROUS
1	15.6	13.7	13.7
2	15.5	14.3	14.3
3	13.8	14.0	14.7
4	13.7	13.1	13.3
S	10.0	8.6	8.1
A	14.5	14.0	14.3
B	10.3	9.9	9.9
C	3.3	1.0	1.0

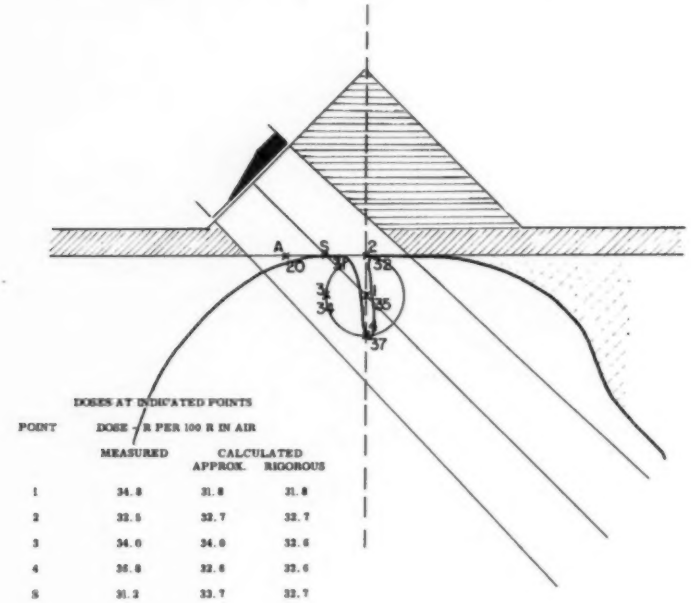
Fig. 6. Treatment plan for 5-cm. beam angled at 45°, using wedge filter, 250 kv.p., h.v.l. 1.8 mm. Cu, 50 cm. target-skin distance, radius of wax cone 18 cm. Numbers on diagram indicate measured doses in roentgens per 100 roentgens in air at end of treatment cone, without wedge filter. Inset table compares measured doses with those calculated by approximate and rigorous methods.

DISCUSSION

In treatment of deep-seated lesions, instead of irradiating from one side only and using a wedge for homogeneity, cross-firing with two rotation fields without a wedge filter may give a preferable distribution. Or rotation over one surface may be combined with fixed portals over the other; such a plan is shown in Figure 9. For these lesions, a question to be decided is whether any form of horizontal rotation is preferable to simple vertical rotation. No categorical answer is possible at the present time; each case must stand as an individual problem until a considerable amount of data is collected.

As cases are studied experimentally, it is found advantageous to determine doses at enough points so that isodose maps for the complete rotation can be constructed (Fig. 10). With such a map for any particular field, tilt, and radius, radiation distribution throughout any mass lying within it can immediately be obtained.

Horizontal rotation therapy—or, in fact, any kind of rotation therapy—has a limited field of usefulness. For any particular lesion, the aim is to irradiate the tumor uniformly, with the best possible differential between doses to tumor and other tissues and with the least possible discomfort to the patient. To this end, possibilities of various types of moving field therapy, or combinations of moving and static fields, should be considered. As experience is gained and results accumulate, cases of various types will probably fall into definite classifications of preferred treatment plans.



DOSES AT INDICATED POINTS

POINT	DOSE - R PER 100 R IN AIR		
	MEASURED	CALCULATED APPROX.	CALCULATED RIGOROUS
1	34.8	31.8	31.8
2	32.5	32.7	32.7
3	34.0	34.0	32.6
4	36.8	32.6	32.6
S	31.2	33.7	33.7
A	19.7	16.3	16.9

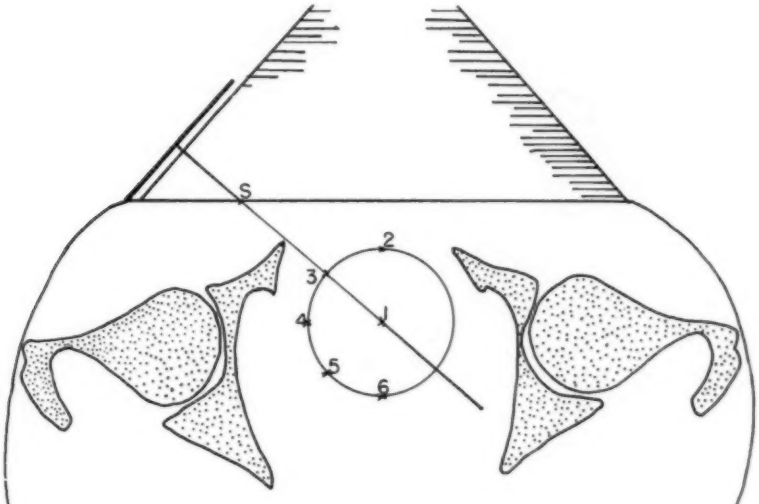
Fig. 7. Treatment plan for 4-cm. beam angled at 45°, using wedge filter. 250 kv.p., h.v.l. 1.8 mm Cu, 50 cm target-skin distance, radius of wax cone 12 cm. Numbers on diagram indicate measured doses in roentgens per 100 roentgens in air at end of treatment cone, without wedge filter. Inset table compares measured doses with those calculated by approximate and rigorous methods.

SUMMARY

Horizontal, or short-axis, rotation therapy has definite advantages in irradiating certain lesions. In this procedure the

beam enters the patient's body at an angle to the skin surface; the result is that the more superficial part of the continuously irradiated region receives a considerably higher dose than the deeper part. This inequality can be partially overcome by the use of a wax cone placed above the skin in such a manner that the end of the treatment cone just skims around the wax cone surface during rotation. By additional employment of a suitable wedge filter, the inequality of dosage can be wholly eliminated.

Variables to be considered in practice are quality of radiation, target-skin distance, angle of tilt, and radius of path of the beam on the skin surface. Preliminary checks indicated that it was desirable to use a fairly high half-value layer and a target-skin distance not less than 50 cm. A 45° tilt appeared suitable for many cases encountered in practice; the radius of the skin path depended on the depth of the lesion.



ROTATION THERAPY
250 KVP 6 CM. CONE NO WEDGE FILTER

	HVL 0.5 MM. CU. TSD 40 CM.	HVL 1.8 MM. CU TSD 50 CM.
POINT	DOSE IN R PER 100 R IN AIR AT END OF CONE	
1	15.0	25.0
2	19.0	30.0
3	17.0	26.6
4	11.9	21.3
5	8.0	18.0
6	7.5	16.5
S	11.4	12.5

Fig. 8. Comparison of dose distribution with two qualities of radiation, as indicated on inset table. No wedge filter.

Using radiation with h.v.l. 1.8 mm. Cu and a 50-cm. skin-target distance, and suitably constructed 45° wedge filters, depth dose measurements were made in a unit density presdwood phantom, for the construction of isodose charts in four planes at 0°, 30°, 60°, and 90° to the plane in which the wedge exerted its greatest effect.

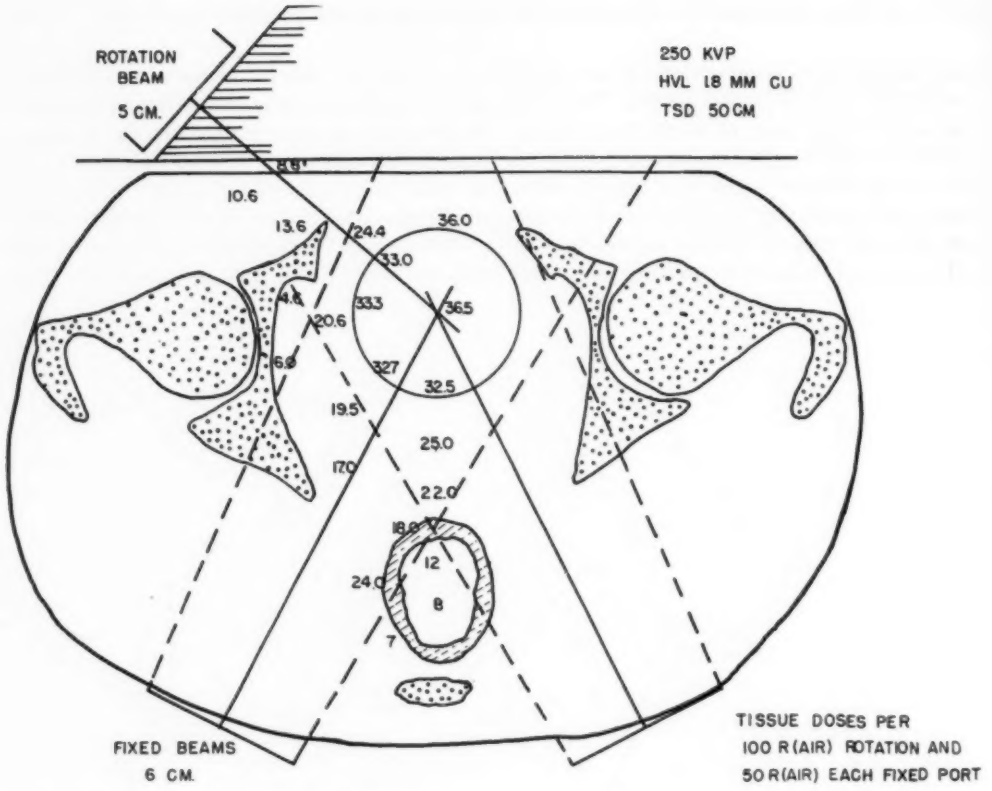


Fig. 9. Treatment plan for combination of rotation over anterior surface of body and two fixed ports over posterior, no wedge filter.

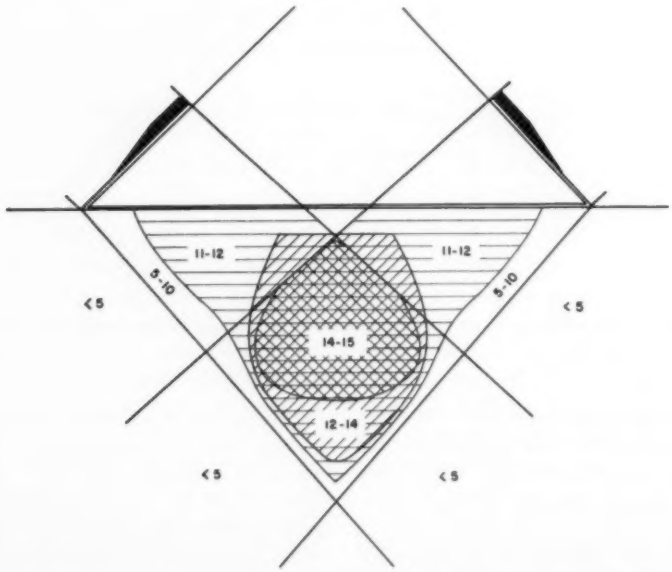


Fig. 10. Isodose map for treatment plan as indicated. 49° tilt, 6-cm. cone, 250 kv.p., h.v.l. 1.8 mm. Cu, target-skin distance 50 cm., radius of wax cone 20 cm. Dose per 100 r in air at end of treatment cone, without wedge filter.

By means of these curves, doses were calculated for many points in lesions of various sizes and at various depths, by the method of Green, Jennings, and Bush (2). The calculated values were checked by measurements in a rotating phantom; good agreement was obtained in all cases.

Since this method of calculation is arduous, an effort was made to develop a procedure for determining approximate doses, which should be adequate for preliminary study of applicability of the method to a particular case. Such a procedure is presented; the results are quite satisfactory. Details and applications to special problems are given.

In appendixes are supplied instructions for construction of the wax cone and of the wedge filters, and the rigorous dosage calculation method of Green *et al.*

APPENDIX I

The Construction of the Wedge Filter

The wedge filter to give a 45° tilt to the isodose lines is constructed according to Groom's formula (3)[6]. It is planned to fit at the lower end of the treatment cone, and is therefore the size of the actual field.

This filter is of the "plateau" type (Fig. 11), consisting of a flat plateau, a sloping portion with constant angle, and an open space. The sloping portion occupies 0.6 of the total beam width, the plateau and the open space each 0.2. The height of the plateau is calculated from the formula

$$\text{Plateau height in inches}^{7} \text{ of copper or brass} = \frac{\text{Field width in cm.}}{60}$$

Thus for a field width of 6 cm. the filter will consist of a plateau 1.2 cm. wide and 0.1 inch (2.54 mm.) thick, followed by a sloping portion 3.6 cm. across the base and an open portion 1.2 cm. wide. This filter is to be mounted in the treatment cone in such a manner that the thick part will be farthest from the skin and the thin part nearest it, as seen in Figures 3, 4, 5, etc.

With the dimensions specified, the wedge can either be built up of laminations or machined from a single piece of brass or copper. Brass has essentially the same absorbing properties as copper and may be easier to work with.

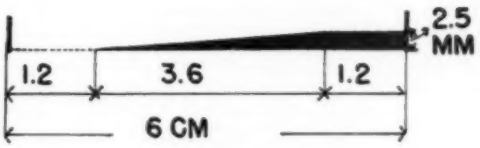


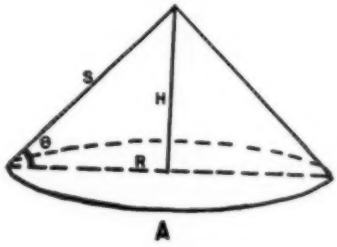
Fig. 11. Plateau type wedge filter.

APPENDIX II

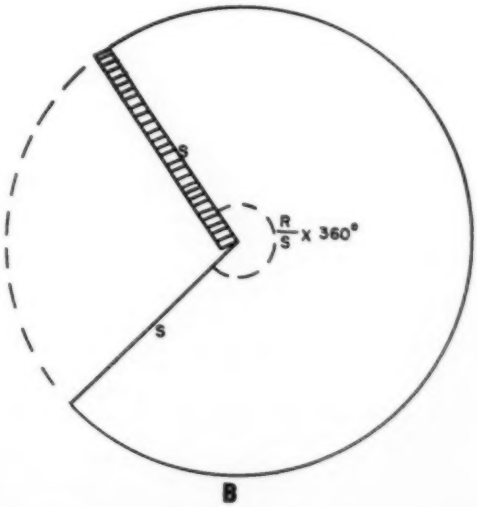
The Wax Cone

The wax is to be poured into a sheet metal pattern constructed as follows (see Fig. 12A):

R = radius of base of cone
H = altitude of cone
θ = angle of tilt
S = slant height of cone = R cos θ
Circumference of base = $2\pi R$
For 45°, H = R, and S = 1.4 R



A



B

Fig. 12. Construction diagrams for 45° wax cone.

[6] Groom's formula was developed for x-rays of 1.1 mm. Cu h.v.l.; it has been found entirely satisfactory for h.v.l. 1.8 mm. Cu.

[7] It is convenient to have this thickness in inches, since in the machine shop where the filter will be constructed the English system of measurements is likely to be employed. It is a simple matter to calculate the millimeter equivalent if desired.

TABLE IV: DOSAGE CALCULATIONS FOR POINT P, FIGURE 13; NO WEDGE FILTER

Segment	Reading at V	Factor	Product
1	54	0.205	11
2	44	0.090	4
3	20	0.074	1.5
4	10	0.067	0.7
Sum	17.2 r at point per 100 r in air		

Lay out a circle whose radius is the slant height of the cone (Figure 12B). The circumference of this circle is $2\pi s$. The part of this circle which will be used for the cone is given by $\frac{2\pi R}{2\pi s} \times 360°$. For a 45° tilt, this ratio is $\frac{1}{1.4}$, or 260° of the circle will be used. Lay this off as indicated, using a protractor.

If this 260° is cut out and edges SS are brought together, a 45° cone will result, whose slant height is the radius of the circle. In practice, it is necessary to leave a flap (indicated by the shaded portion), which will furnish an overlap for joining the edges by soldering or otherwise.

For use, the cone should be lined with waxed paper, the melted wax poured in and allowed to harden. After it has cooled, there will be a depression in the center, which will have to be filled by one or more small additions of melted wax. One master cone will suffice for all 45° wax cones, it is only necessary to calculate the slant height for a given base radius and fill with wax to that level.

APPENDIX III

Method of Calculating Average Dose Rates at a Point, According to Green, Jennings, and Bush[8]

A. No wedge filter.

1. Draw cross section of patient, with tumor, with beam in position, and axis of rotation indicated, as shown in Figure 13.

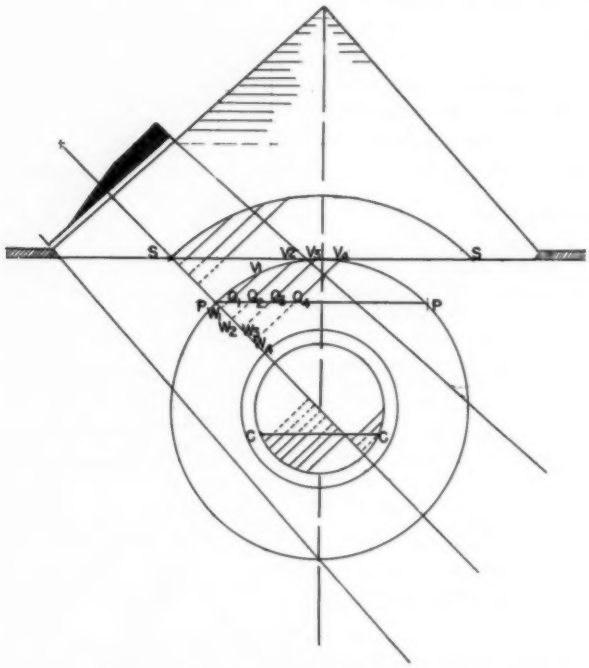


Fig. 13. Diagram for dosage calculation according to Green, Jennings, and Bush.

2. For any point on the axis of rotation, the dose is read directly from the isodose charts, just as in the "approximate" method described in the paper.
3. For any point, P, not on the axis of rotation, drop a perpendicular to the axis of rotation, and continue it for an equal distance beyond. This line, PP, is the diameter of the circular path described by P as the body rotates.

[8] For the theoretical development, see their original paper (loc. cit.).

TABLE V: DOSAGE CALCULATION FOR POINT P, FIGURE 12, USING WEDGE FILTER

Segment	WQ (mm.)	WV (mm.)	Cos θ	θ	Dose at V	Factor	Product
1	4	19	0.210	78°	27	0.205	5.5
2	9	32	0.281	74°	23	0.090	2.1
3	15	39	0.383	67°	10	0.074	0.7
4	21	46	0.457	63°	5	0.067	0.3
Sum							8.6 r at point per 100 r air

4. Using the point of intersection of the axis of rotation and the axis of beam as center, draw an arc of a circle, PP. If the entire path of the point is within the continuously irradiated region, draw the complete circle.
5. Divide the chord PP into ten or twenty equal parts and indicate the *mid-point* of each part,[9] Q_1, Q_2, Q_3, etc.
6. Through these points Q_1, Q_2, etc., draw perpendiculars to the axis of the beam, extending them on to intersect the arc or circle, PP. (It is helpful to draw the part between Q and the axis as a dotted line and the part between Q and the circle as solid.) Intersections with the beam axis are indicated as W_1, W_2, etc.; those with the circle as V_1, V_2, etc.
7. As the point P travels around its circular path at a uniform rate, the foot of the perpendicular Q travels back and forth along PP in simple harmonic motion. Equal distances between the Q's do not correspond to equal distances along the path, as is evident from Figure 14. The part of the rotation period during which P travels, for each of the equal distances, Q_1Q_2, Q_2Q_3, etc., can be determined from the cosine equation for simple harmonic motion. If each of these parts is multiplied by the dose rate given by V when P is at the mid-point of the section, the sum of these products will be the total dose received by the point during half a revolution. Twice this sum will be the total dose for the whole revolution, since the motion is symmetrical. The same result is achieved by multiplying each partial dose by twice the factor for the partial path. In Table I these double factors have been given, for ten and for twenty equal divisions of the chord. The larger number will give more accurate values, especially when the point is traversing the rapidly changing region near the edge of the isodose charts.

[9] Note that in Figure 4, for the approximate calculations, the lines were drawn through the points of division of the segments, not through the mid-points.

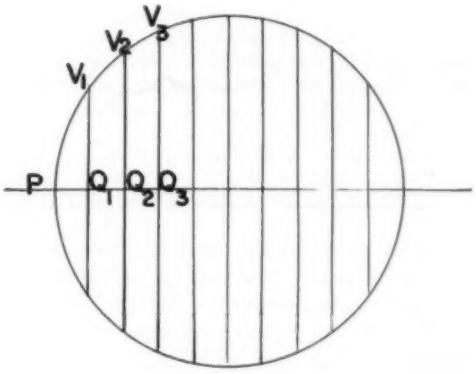


Fig. 14. Diagram to illustrate relative motion of point on circular path and of its projection on the diameter of the circle.

Accordingly, place the transparent isodose chart over the diagram and tabulate dose rates for all positions of V. Multiply each by the correct segment factor and add results. The sum gives the dose in roentgens delivered at the point per 100 roentgens in air at the end of the treatment cone. For point P of the diagram, the calculations are given in Table IV, for a 6-cm. beam as indicated.

B. Using a wedge filter.

1–6. The same as without a wedge filter.

7. With the symmetrical non-wedge isodose curves, it makes no difference whether the arc PP larger than a semi-circumference is used instead of the smaller one. With the wedge, the side selected makes a great difference in the dosage reading. The rule is that Q and V must always be on the same side of the axis of the beam. (See lines for point C).

The angle through which the point has traveled must also be considered, as the proper isodose curve must be used for each reading. It can be shown that for any position, Q, of the projection of point P, the angle which has been turned through is given

by $\theta = \cos^{-1} \frac{WQ}{WV}$. Accordingly, for each position of Q these lengths must be measured, and the angle determined from a table of cosines (or by some other method). The dose for that particular V is then read from the isodose curve for that angle, or determined by interpolation between the curves for the nearest two angles. Each V value is then multiplied by its segment factor, as before. An example is given in Table V.

ACKNOWLEDGMENTS: The authors wish to acknowledge their indebtedness to the American Cancer Society for the generous support of this study. They also wish to express their gratitude to Miss Beverly Singer for her assistance in the experimental work.

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SUMARIO

Determinación de la Dosis para la Terepéutica Rotatoria en el Plano Horizontal

La terapéutica rotatoria horizontal, o de eje corto, posee ventajas bien definidas al irradiar ciertas lesiones. En este procedimiento, el haz penetra en el cuerpo del enfermo en ángulo a la superficie cutánea, dando esto por resultado que la parte más superficial de la región irradiada continuamente recibe una dosis considerablemente mayor que la parte más profunda. Puede subsanarse parcialmente esa desigualdad con el uso de un cono de cera colocado más arriba de la piel, de modo que el extremo del cono terapéutico se deslice precisamente alrededor de la superficie del otro cono durante la rotación. Empleando además un filtro cuneiforme adecuado, puede eliminarse por completo la desigualdad de dosis.

Factores variables que hay que considerar en la práctica son la calidad de la irradiación, la distancia foco-piel, el ángulo de inclinación, y el radio del paso del haz sobre la superficie cutánea. Comprobaciones preliminares indicaron que convenía usar una capa de hemirreducción bastante alta y una distancia foco-piel de no menos de 50 cm. Una inclinación de 45° pareció adecuada para muchos casos observados en la práctica; el radio del paso cutáneo se regía por la profundidad de la lesión.

Usando irradiación con c. de h.r. de 1.8 mm. de Cu y una distancia foco-piel de 50 cm. y filtros en cuña de 45° construídos adecuadamente, se hicieron mediciones de la dosis a profundidad en un fantasma Presdwood de densidad para la elaboración de gráficas de isodosis en cuatro planos a 0°, 30°, 60° y 90° al plano en que la cuña ejercía su efecto máximo.

Por medio de esas curvas, calculáronse las dosis para muchos puntos en lesiones de varios tamaños y a varias profundidades por el método de Green, Jennings y Bush (Acta radiol. 31:273, 1949). Los valores calculados fueron cotejados con las mediciones realizadas en un fantasma rotatorio; obtúvose bastante acuerdo en todos los casos.

Como ese método de cálculo es árduo, se elaboró un procedimiento para determinar dosis aproximadas, que resultó adecuado para el estudio preliminar de la aplicabilidad del método a un caso dado. Descríbese este procedimiento, dándose detalles y aplicaciones a ciertos problemas.

Los apéndices contienen instrucciones para la construcción del cono de cera y de los filtros en cuña y describen el método de Green, Jennings y Bush para el riguroso cálculo de la dosis.

DISCUSSION

Lester S. Skaggs, Ph.D. (Chicago): That Dr. Quimby's paper is very timely is evident. Even more than this, it is important as indicating that rotation therapy can be used with the ordinary equipment available in most therapy centers.

I am bothered a bit by the terminology. The terms "vertical" and "horizontal" seem to refer to the position of the long axis of the patient during treatment. Since we are getting away from these particular orientations of the patient, it would seem that some other terms should be found. "Perpendicular rotation" could be substituted for "vertical rotation," and for "horizontal therapy" we might find a more descriptive term such as "convergent beam therapy," or possibly "short-axis therapy," as Dr. Quimby suggested.

Without filters and without bolus to provide a more uniform field over the region of the tumor, this type of therapy has not promised too much because of the very rapid changes of radiation dose. With the use of filters and bolus, it is possible to get, as Dr. Quimby has pointed out, a very uniform distribution, so that a profitable use of this type of rotation may be made.

The choice of only a few physical factors in laying out the dose, of course, makes this form of therapy more practical and makes it easier to determine the best way in which to treat the tumor.

Dr. Quimby's point that no particular form of rotation is a panacea, and that there is no shortcut from hard work and careful consideration, should be taken to heart. I think we are going to have to consider all the forms of treatment, the various forms of rotation and the different methods of fixed beam therapy, and the possible combinations of the two.

Dr. Quimby (*closing*): I would just like to add my agreement to the fact that we have no proper system of nomenclature for this type of therapy. I think the terms "long-axis rotation" and "short-axis rotation" are due to Smithers. In long-axis rotation the patient turns around a line parallel to his own vertical axis (or possibly coincident with it); in short-axis rotation he turns around one perpendicular to this. Sometimes he is rotated about an axis in still a different direction.

We have also "convergent-beam therapy," actually applicable to any type of cross-fire but now rather pre-empted for a particular type of machine with a moving x-ray tube, "pendulum therapy," in which the tube describes an arc about the patient, and so on.

With the greatly increased use of various types of moving field therapy, it is highly desirable that someone should develop an acceptable system of terms which can be generally adopted.

Practical Telepelvimetry[1]

B. S. WOLF M.D., and ROBERT LOEVINGER, Ph.D.

THE POSSIBILITY OF utilizing long target-film distances for pelvic mensuration in order to minimize magnification has been considered for some time. Efforts in this direction have been limited, however, by the power output of diagnostic equipment. Therapeutic equipment has been tried (2), but is awkward and inconvenient to use. The recent general availability of diagnostic voltages above 100 kv.p. suggested that a reinvestigation of the problem was in order.

Suitable exposure factors for the anteroposterior projection of the pelvis and abdomen at or near term were first investigated, on the premise that the length of exposure should not be excessive. Factors of 120 kv.p. and 100 ma. were adopted in order to keep well below tube limits. The routine radiographic tube had an added filter of 2 mm. of aluminum. The 16-to-1 grid was found to be necessary in order to obtain films of satisfactory quality. With the patient flat on her back on the table, the required time of exposure did not exceed two seconds at a target-film distance of 72 inches. It was found feasible to elevate the shoulders to produce an angulation of 20 degrees between the patient's back and the table without increase in the exposure time beyond three seconds. Despite the use of the routine commercial 16-to-1 grid, which is focused for a 40-inch target-film distance, cut-off at the edges was not troublesome. In fact, the diminished exposure along each side of the film appeared to have some advantage by producing a more uniform over-all density. The use of a 2 mm. focal spot did not have any significant disadvantage as compared with a 1 mm. spot. Either phototiming or conventional timing was practical.

In order that the technic for the anteroposterior projection should be as reproducible as possible, it was decided that this view should be taken with the patient flat on the table. After determining that a target-film distance of 72 inches was practical, it was necessary to investigate the variation in the magnification factors (or the reciprocal of the magnification factors, *i.e.*, the "correction factors") from patient to patient for the pertinent transverse pelvic diameters. For this purpose, a method of measurement was required which would be as accurate as possible. Such a method was devised on the basis of the familiar stereoroentgenometric technic (3). This was intended for investigative purposes or special problems and not for routine use. A target-film distance of 72 inches was maintained, a tube shift of 8 inches was used, and lead markers were placed on the table-top to permit accurate registration of the two films. The lead markers consisted of six flat lead "buttons" distributed over the film area within a thin plastic sheet. Each button contained two small holes, separated by a distance of 5.6 mm. in the direction of the tube shift, *i.e.*, along the long axis of the table. The distance between images of the two holes on each film was then equal to the shift of an object on the table-top (table-top-to-film distance of 5.0 cm.). The stereo pair of films could be registered by superimposing the images of the top holes, on the film taken with the target toward the head, with the images of the bottom holes on the film taken with the target toward the feet. In practice, measurements were made by marking the anatomical end-points of the pertinent diameters of each film in turn on a transparency and measuring the shift of the end-points so recorded, with care to superimpose the correct row of holes of each film. The precision of

[1] From the Departments of Radiology and Obstetrics and the Physics Laboratory of the Mount Sinai Hospital, New York, N. Y. Accepted for publication in August 1953.

this method was considerably greater than the errors introduced by the necessity of identifying the identical anatomical endpoints on the two films.

The results of investigating over 100 patients by the stereoroentgenometric method indicated that single correction factors for the transverse diameters of the pelvis could be established which, in actual use, would not be in error by more than ±1.5 per cent. The range of ±1.5 per cent is equivalent to a variation in the height above the table-top of 6 cm. In the large majority of cases, the error would be ±1 per cent or less, representing 1.0 mm. in a measurement of 10 cm. Since it is not likely that greater accuracy than this will be required for clinical purposes, an average correction factor can be adopted and applied to all cases.

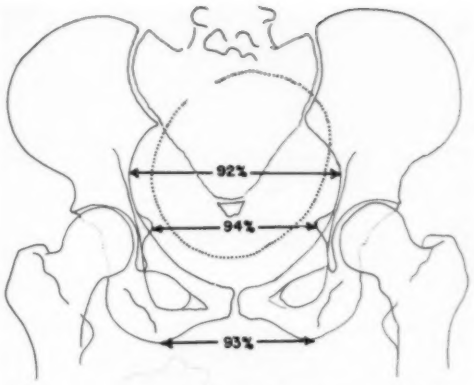

Fig. 1. Drawing of pelvis in the anteroposterior projection at 72 inches target-film distance. The maximum transverse diameter of the inlet, the interspinous diameter, and the "anteroposterior intertuberous" diameter are illustrated, with the average correction factors.

TABLE I: AVERAGE CORRECTION FACTORS FOR TRANSVERSE PELVIC DIAMETERS, ANTEROPOSTERIOR VIEW, FLAT

Diameter	Correction Factor, Target-Film Distance 72″, Table-top-Film Distance 2″	Average Height Above Table Top	Correction Factor, Target-Film Distance 60″, Table-top-Film Distance 2″
Maximum transverse of inlet	92.0%	9.5 cm.	90.5%
Interspinous	94.0%	5.5 cm.	93.0%
Intertuberous, A.P.	93.0%	7.5 cm.	91.5%
Interacetabular	91.0%	11.5 cm.	89.0%

Note: For other table-top-film distances, correction factors may be calculated from the average heights of the diameters above the table-top.

Table I shows the average correction factors for the transverse diameters of the pelvis illustrated in Figure 1. Since these "average" figures would no doubt vary slightly, depending on the selection of patients for pelvimetry, it was considered that they should be given only to the nearest 0.5 per cent. The average table-top distances were considered to be accurate only to the nearest 0.5 cm. The last column in Table I, correction factors for 60 inches target-film distance, was calculated from the correction factors determined at 72 inches. Using the average table-top heights of the various diameters, one may calculate single correction factors for any target-film distance. At short target-film distances, however, the potential error in the use of single factors increases rapidly. At 40 inches, the estimated error may be as great as ±4 per cent.

In the same fashion in which these correction factors were established, it is possible to find suitable correction factors for any transverse diameter of the pelvis of special interest. Despite the fact that the engagement of the head was variable (the patients were examined from the thirty-sixth to the fortieth week of pregnancy), a correction factor of 89 per cent for the diameters of the head in the anteroposterior projection showed no error greater than ±2.5 per cent, equivalent to an average head-to-table-top distance of 15 cm. This error can be decreased by approximate triangulation if a lateral view is available.

A disadvantage observed in the use of the 72-inch target-film distance for the anteroposterior projection with the patient lying on the table was the fact that

Fig. 2. Anteroposterior projection of abdomen taken at 72 inches target-film distance with the patient flat on the table and the central ray centered halfway between the center and top of the film.

the ischial spines were frequently projected within the pubic rami, particularly if the patient was not perfectly flat. It was found, however, that the spines could be projected above the pubic rami if the central ray was centered halfway between the middle and top of a 14 × 17-inch film arranged with its long axis along the long axis of the patient (Fig. 2). The iliac crests were placed at the center of the film. Despite the fact that the pelvis is in the lower half of such a film, no geometrical error is introduced in the application of the correction factors given above. The use of the large film permits a view of the entire fetus and uterus. Visual estimates of fetal size and direct comparison of the various transverse diameters are more reliable because of the decreased divergent distortion of the long target-film distance.

An "outlet" view according to the technic of Chassard and Lapiné is frequently included in routine pelvimetry. It was found possible to obtain this view at a target-film distance of 72 inches, with 120 kv.p. and the 16-to-1 grid, without exceeding an exposure time of three seconds (Fig. 3). The geometrical errors in the measurement of the subpubic angle are decreased by using longer target-film distances. The "white" lines convex medially, marking the medial surfaces of the

Fig. 3. Chassard-Lapiné outlet view taken at 72 inches. (The six lead buttons, each with two holes in it, permit registration of the pair of films when the stereoroentgenometric method is used.)

ischia, are well shown in this projection, and the minimum distance between these lines can be conveniently measured. In Figure 4, this distance is designated as the outlet "intertuberous" diameter. Average correction factors for this and other selected diameters illustrated in Figure 4 are given in Table II. These were derived in the same fashion as the factors of Table I, by use of the stereoroentgenometric method. The maximum error did not exceed ±1.5 per cent. Fortunately, the average correction factor for the interacetabular diameter in this projection is the same as for the intertuberous outlet diameter, so that a direct visual comparison of these two diameters gives a correct impression of the divergence or convergence of the "side walls" of the pelvis.

In the majority of cases of cephalic presentation with the patient not in labor, an estimate of the suboccipito-bregmatic diameter of the fetal head could be obtained from the outlet view. The error in using a single correction factor of 90.5 per cent for this diameter was less than ±1.5 per cent.

For the routine lateral view of the pelvis to determine the mid-line sagittal diameters, there is no theoretical geometrical error in the use of an isometric ruler in the internatal cleft, provided the pelvis is symmetrical. Errors in this method arise from incorrect positioning of the patient or ruler. These positional errors can be minimized by utilizing a longer target-film distance. For this projection, however, target-film distances greater than 54 inches require exposure times greater than three seconds in many cases, despite the use of 120 kv.p. Using a target-film distance of 54 inches (and in the erect Bucky actually used, a table-top-film distance of 4.0 cm.), the variation in the mid-line correction factor was from 83 to 88 per cent. The large majority of the individuals in this series showed a correction factor of either 85 or 86 per cent. The use of the single figure, 86 per cent, would correspond to an average table-top distance of 15.5 cm. and would give a maximum error of about ±3 per cent due to geometrical factors. The radiopacity of the isometric ruler must be increased if it is to be easily visible on the film made at 120 kv.p. This can be done by wrapping the usual metallic ruler with lead sheet.

Incidentally, the use of a grid-front cassette with high-speed screens, in addition to the 16-to-1 moving Bucky grid, produced distinctly superior contrast without requiring any increase in exposure time. The effect of a cross-hatched grid was obtained by placing the grid lines of the cassette perpendicular to the grid lines of the moving Bucky diaphragm. This combination of grids was most useful for the lateral projection.

It would be highly desirable to be able to use a long target-film distance for the Thoms view of the inlet. This view would then furnish both quantitative and qualitative information about the inlet in simple fashion. However, an exposure time of three to four seconds is required at 120 kv.p. for this projection at a target-film distance of 40 inches. Longer target-film distances are therefore not considered to be practical at this time. According to the data of McDowell (4), recalculated for a target-film distance of 40 inches, the

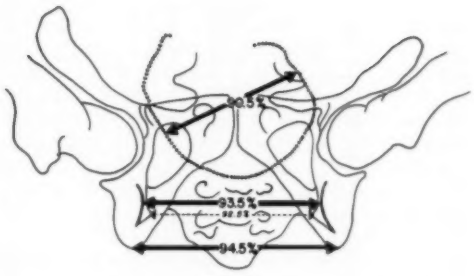

Fig. 4. Drawing of outlet view, showing the suboccipito-bregmatic diameter of the head, the "outlet intertuberous" diameter between the medial surfaces of the ischia ("white lines"), and the "alternative outlet intertuberous" diameter between the lowest points of the tuberosities with the average correction factors. Various "intertuberous" diameters are illustrated in this figure and Fig. 1, since there is no general agreement on the use of any single diameter. The "outlet intertuberous" diameters are larger than the "anteroposterior intertuberous" of Fig. 1. The spines are rarely seen sufficiently well in this projection to permit measurement of the interspinous diameter.

TABLE II: AVERAGE CORRECTION FACTORS FOR PELVIC DIAMETERS: CHASSARD-LAPINÉ OUTLET VIEW

Diameter	Correction Factor, Target-Film Distance 72", Table-top-Film Distance 2"	Average Height Above Table Top	Correction Factor, Target-Film Distance 60", Table-top-Film Distance 2"
Intertuberous outlet	93.5%	6.5 cm.	92.0%
Alternative intertuberous outlet	94.5%	5.0 cm.	93.5%
Interspinous	92.5%	8.5 cm.	91.0%
Suboccipito-bregmatic diameter of head	90.5%	12.0 cm.	88.5%

Fig. 5. False or expanded ruler with 92 per cent correction on one edge and 86 per cent correction on opposite edge. The extreme portion of the 86 per cent edge gives correction factors when the rule is applied to the image of an opaque 15 cm. ruler in the interspinous cleft. The first portion of the 92 per cent edge gives directly the correction factors when applied to the shift distances in the stereoroentgenometric technic outlined in the text. Actual size.

correction factor for the inlet in this view ranged from 82 to 86 per cent in a series of 250 cases; in 80 per cent of these cases, it was between 83.5 and 85.5 per cent. A single figure of 84 per cent would have produced no error greater than ±2.5 per cent. At any rate, if a Thoms inlet view at 40 inches as well as the anteroposterior projection at 72 inches is included in the routine examination, the correction factor for the plane of the inlet can easily be determined. It is simply the ratio of the true length of the maximum transverse diameter of the inlet obtained from the anteroposterior projection to the length of the same diameter measured on the inlet film. Other inlet measurements, *e.g.*, the available transverse diameter (5) or the diameter of the largest circle which would fit the inlet, can then be obtained by using the inlet correction factor determined in this fashion. Moreover, the interspinous diameter can be obtained from this view by using a correction factor 4 per cent greater than the correction factor for the plane of the inlet. This is equivalent to an average distance of 4 cm. between the level of the spines and the plane of the inlet. When the interspinous diameter is large, the spines may be difficult to identify on the flat anteroposterior projection but are usually seen sufficiently well on the Thoms view (taken at 120 kv.p. with the 16-to-1 grid) to permit a double check.

For everyday use of the average correction factors, it is convenient to incorporate them in a so-called false or expanded ruler (Fig. 5). The suitable scales can then be applied directly to the films. A 92 per cent scale on one edge of such a ruler may be used for the maximum transverse diameter of the inlet. For other correction factors, *e.g.*, 94 per cent for the interspinous diameter, the same scale may be used and 2 mm., *i.e.*, the difference between 94 per cent and 92 per cent, added to the result. As another example, the 92 per cent scale may be used for the suboccipito-bregmatic diameter of the head in the outlet view (correction factor 90.5 per cent) by subtracting 1.5 mm. from the 92 per cent scale measurement. An 86 per cent expanded scale on the opposite edge of the same ruler may be used in similar fashion to measure the anteroposterior diameters in the lateral projection.

A second advantage anticipated from the use of higher voltages for pelvimetry was the increased exit dose relative to the radiation dose to the patient and fetus. In order to estimate what this advantage might be, ionization measurements were made at a depth of 12 cm. in a Presdwood Masonite phantom 24 cm. in thickness, *i.e.*, at about the level of the ovaries in a thick pelvis. The dose at 12 cm. depth with the phantom on the x-ray table was measured at 120 kv.p. and a "target-film distance" of 72 inches and also at 80 kv.p. and a "target-film distance" of 40 inches. The milliampere-seconds required to produce equivalent anteroposterior radiographs of the pelvis, using the 16-to-1 grid at 120 kv.p. at 72 inches and the 8-to-1 grid at 80 kv.p. at 40 inches, were determined on the same patient. To achieve equivalent radiographic results, it was found that the dose at 12 cm. depth with the high-voltage technic was approximately 60 per cent of the dose with the 80 kv.p. technic.

ADDENDUM: Since the original draft of this report was prepared, a similar technic for the anteroposterior projection based on similar geometrical considerations has been published by Curry (1), using a target-film distance of 60 inches. He did not, however, utilize higher voltages. The correction factors for the maximum transverse diameter of the inlet and the interspinous diameter, calculated for 60 inches, were, to three figures, 0.904 and 0.927 in the present report as compared with 0.903 and 0.922 obtained by Curry. We consider these results to be in essential agreement. Since these factors might have been markedly dependent on the selection of cases sent for pelvimetry as well as the type of population being sampled, the fact that the results were the same in both investigations is an indication of the validity of the method.

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SUMARIO

Telepelvimetría Práctica

Investigóse el empleo de distancias foco-piel largas para la medición pelviana a un p. de 120 kv. y se estudió la variación en los factores de aumento (o la recíproca de éstos, o sean "factores de corrección") observada de enfermo a enfermo. Para este fin se empleó una técnica estereorroentgenométrica. Preséntanse factores de corrección para la vista anteroposterior con el enfermo de plano en la mesa y para la vista de salida de Chaussard-Lapiné.

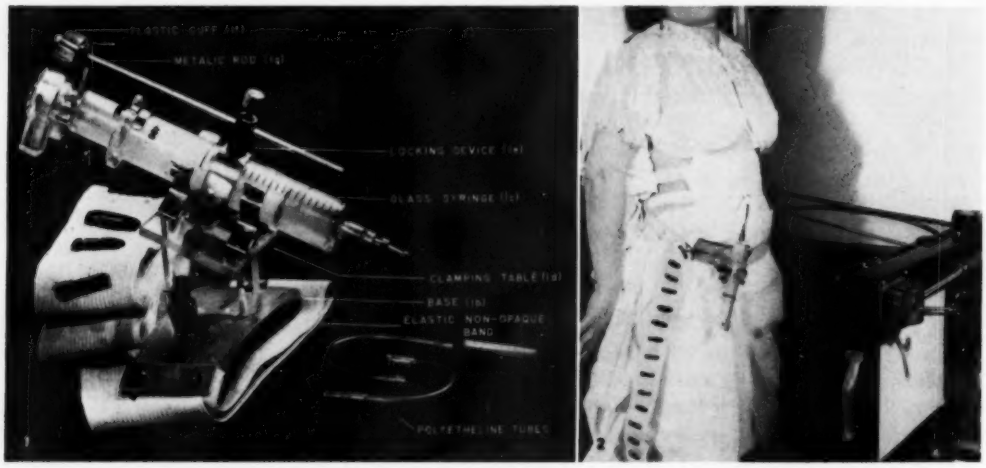
Descríbese e ilústrase una regla llamada falsa o expandida que incorpora los factores de corrección y que en la práctica corriente puede aplicarse directamente a la película.

Upright Cholangiography[1]

A New Device for Simplifying Cholangiography

ANTHONY G. BOREADIS, M.D.

IN ORDER TO facilitate the holding of the injection apparatus during cholangiography, a device has been designed which has proved of great aid in performing this examination in different positions, particularly with the patient erect.



Figs. 1 and 2. Showing the device and its application with the patient in the upright position.

Description: The device (Fig. 1), constructed of Lucite and metal, is attached to the abdomen with an elastic nonopaque band which encircles the patient and is adjustable for circumferential length by a series of loops. The base (1b) is slightly curved to fit the contour of the body and is padded with sponge rubber. A glass syringe (1c) with Luer lock tip, containing 20 c.c. of 35 per cent Diodrast, is maintained on an elevated inclined clamping table (1d). The syringe is kept in place by a metallic locking device (1e) which also controls the movement of the plunger. The plunger is connected by a plastic cuff (1f) to a metallic rod (1g). This rod slides through the metallic locking device so that the plunger can be held at any desired position or can be moved at will.

Technic: The device is placed over the right anterior lower abdomen (Fig. 2) and kept in this position throughout the entire examination. (It does not interfere with visualization of the biliary ducts and duodenum.) The T-tube is then connected with the syringe. The needle of another, empty (20 c.c.) syringe is inserted in the T-tube and the fluid and air contained in that tube and the biliary tree are aspirated until the tube wall collapses. After aspiration, 2.0 to 4.0 c.c. of opaque medium is injected through the syringe. Under fluoroscopic guidance, serialographic or spot views of the common bile duct and duodenum are taken with the patient recumbent or upright. Additional opaque medium is introduced before each exposure if necessary. Final views are then obtained in the recumbent, Trendelenburg, and upright positions. The entire biliary tract and duodenum may

[1] From the Department of Radiology, Albert Einstein Medical Center, Northern Division, Philadelphia, Penna. Accepted for publication in August 1953.

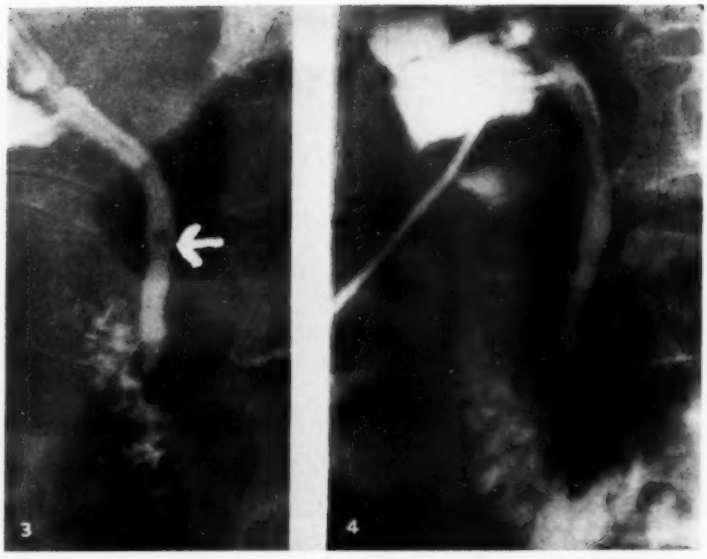


Fig. 3. Roentgenogram made in the right posterior oblique *recumbent* position, showing an air bubble in the common bile duct.

Fig. 4. Roentgenogram of the same patient made in the left anterior oblique *erect* position, showing disappearance of the air bubble and better demonstration of the common bile duct.

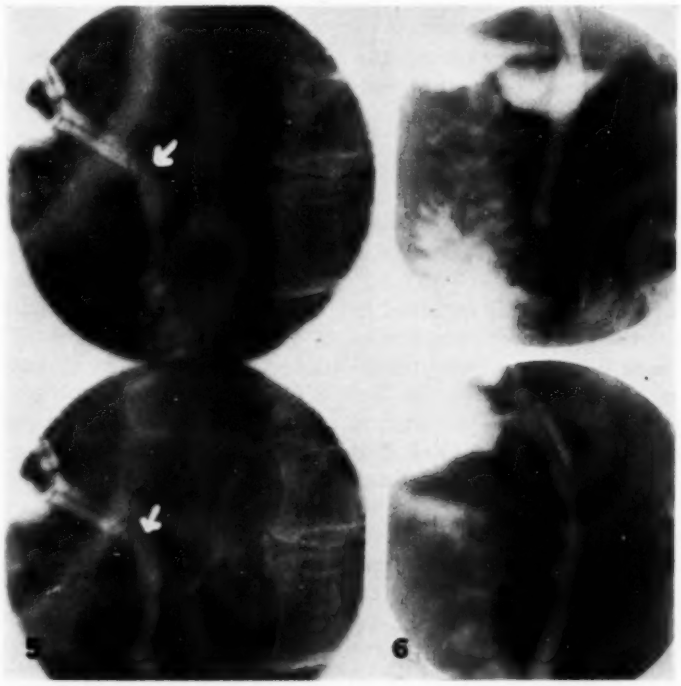


Fig. 5. Spot serialograms made in the *recumbent* position, showing air bubbles within the common bile duct. Incomplete visualization of the distal portion of this duct due to overlapping of the duodenum.

Fig. 6. Spot roentgenograms of the same patient made in the left anterior oblique *erect* position, showing disappearance of the air bubbles and better demonstration of the common bile duct.

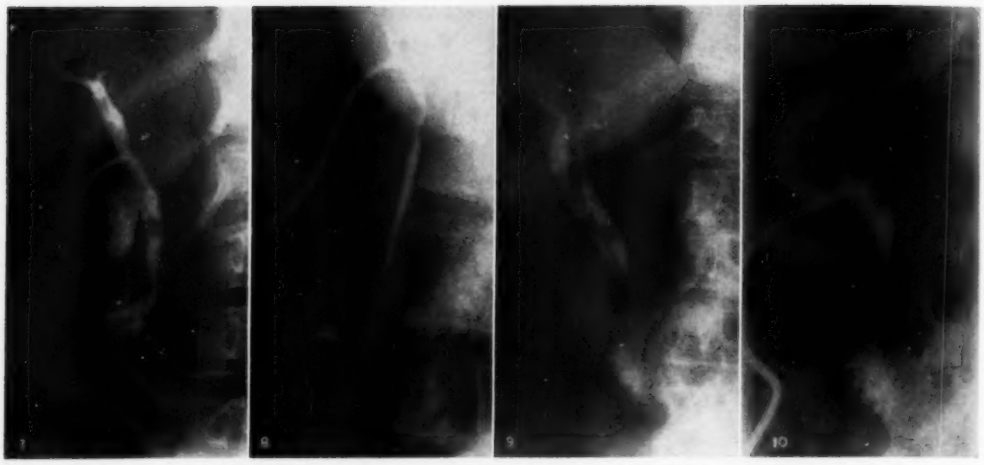


Fig. 7. Roentgenogram made in the right posterior oblique *recumbent* position, showing air bubbles in the common bile duct.

Fig. 8. Roentgenogram of the patient shown in Fig. 7 made in the left anterior oblique *erect* position, showing disappearance of the air bubbles, better demonstration of the common bile duct, and visualization of a pancreatic duct.

Fig. 9. Roentgenogram made in the right posterior oblique *recumbent* position, showing a large radiolucent gallstone within the common bile duct.

Fig. 10. Roentgenogram of the patient shown in Fig. 9 made in the left anterior oblique *erect* position, showing the radiolucent gallstone remaining in the common bile duct. Better visualization of the common bile duct.

thus be visualized without altering the position of the apparatus or the continuity of the fluid system.

DISCUSSION

The following advantages have been evident with the use of this device, as compared with former methods of performing cholangiography:

1. Since the device is firmly attached to the patient, fluoroscopic observations may be performed and films may be obtained in any position. Particularly valuable are studies in the erect position. The common bile duct is usually better visualized, and differentiation of non-opaque gallstones from air bubbles can be made with the patient upright. Air bubbles will disappear from the common duct when the patient is moved from the recumbent to the erect position, whereas gallstones remain.

2. Unsterile material and cumbersome bags are no longer necessary in order to keep the syringe in place.

3. As the T-tube is connected directly with the syringe and needles are not used, there is no danger of penetrating the T-tube, with resultant loss of opaque medium. Injury to the patient by the needle in case of sudden unexpected movement is avoided.

4. Control of the amount and rate of flow of opaque material is effectual. Air bubbles do not enter the system.

5. The operator's hands are free to accomplish any desired manipulation.

6. Considerable economy of time and increased availability of space are achieved, since the patient can be moved to another room with the device in place while films are being developed.

SUMMARY

A new device is described which has simplified the technic of postoperative cholangiography. Fluoroscopy may be performed with greater ease since the patient can be placed in the most desirable position and the operator's hands are free to accomplish proper positioning. Flow of the opaque material is controlled. The entrance of air bubbles into the system is

prevented. Study in the upright position, which permits better visualization of the common duct and differentiation of air bubbles from non-opaque gallstones, can be readily accomplished.

NOTE: An improved model of the cholangiography device described above is manufactured by Picker X-ray Corporation.

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SUMARIO

La Colangiografía Erecta. Nuevo Aparato para Simplificar la Colangiografía

El nuevo aparato aquí descrito ha simplificado la técnica de la colangiografía postoperatoria. Permite ejecutar la roentgenoscopia con mayor facilidad por poderse colocar al enfermo en la posición más conveniente y tener el operador las manos desembarazadas para lograr ese propósito. Se gradúa el paso de la substancia opaca. Se impide la entrada de burbujas de aire en el organismo. Resulta así fácil llevar a cabo el estudio en la posición erguida, que permite mejor visualización del colédoco y la diferenciación de las burbujas de aire de los cálculos biliares que no son opacos. Lógranse además mucho ahorro de tiempo y mejor utilización del espacio disponible, pues puede mudarse al enfermo a otro cuarto con el aparato en posición mientras se revelan las radiografías.

Traumatic Rupture of the Kidney[1]

M. R. HALL, M.D.

THE CARE OF patients with traumatic rupture of the kidney has been and continues to be a controversial subject in urology. Difference of opinion exists both with regard to the method and extent of the radiological investigation necessary for an understanding of the case and as to the form of treatment to be used—conservative non-operative measures or surgery.

With these questions in mind, particularly that of the extent of the radiological investigation, we have reviewed 17 cases of traumatic rupture of the kidney seen in the Toronto General Hospital in the six years from June 1947 to June 1953. X-ray examination included anteroposterior views of the abdomen, intravenous pyelography, and retrograde pyelography.

A plain film of the abdomen may show loss of the kidney shadow or its enlargement, obliteration of the psoas muscle, scoliosis with concavity to the affected side, fractures, etc. The examination is harmless so far as the patient's general condition is concerned, but unfortunately it does not often give much information, because of overlying gas-filled bowel, the results of a paralytic ileus. In 15 of the 17 patients under review anteroposterior films of the abdomen were obtained. In 2 of the cases a large mass was seen on one side, while in 2 others there was evidence of trauma in the region of the kidney, such as fractures of the ribs or of transverse processes of the vertebrae.

Excretory pyelograms are without danger so far as infection is concerned. They are easily obtained and offer valuable information in the majority of cases. They are best done on admission, though at that time failure of function on the injured side may be apparent. A few days later, however, a repeat examination may be satisfactory. The injured kidney may show extravasation of the medium into the parenchyma of varying degree according to the extent of the injury sustained. Deformity of the calyces, pelvis, or ureter may be seen, the result either of blood clot within or of pressure from without by an extrarenal mass. From the point of view of determining the treatment to be carried out, it is of great importance that the condition of the non-injured kidney be observed. Turton and Williamson (4) reported 5 cases in which a congenital solitary kidney sustained injury, and in 4 of these cases nephrectomy was performed.

That cystoscopic examination and retrograde pyelography should be routine procedures is the opinion of certain writers, as Sargent (3), Farman (1), and Orkin (2). They contend that a much better pyelogram is obtained and that extravasation, when present, is much more apparent than on the intravenous study. Opponents of retrograde pyelography maintain that it carries with it the danger of introducing infection and of increasing or re-activating bleeding. Its advocates reply that not only are these dangers more theoretical than real, but also that even if the method is in truth accompanied by these hazards they are more than offset by the danger that may result from mismanagement of the case if the examination is not used.

In 9 of the 17 cases which we have studied, intravenous pyelograms were obtained, and 8 of these gave valuable information. Two of the 8 revealed only non-function on the injured side. In 5 of the cases in which intravenous pyelography was done, retrograde pyelograms were also obtained, and in 2 cases these furnished additional information with regard to the condition of the kidney.

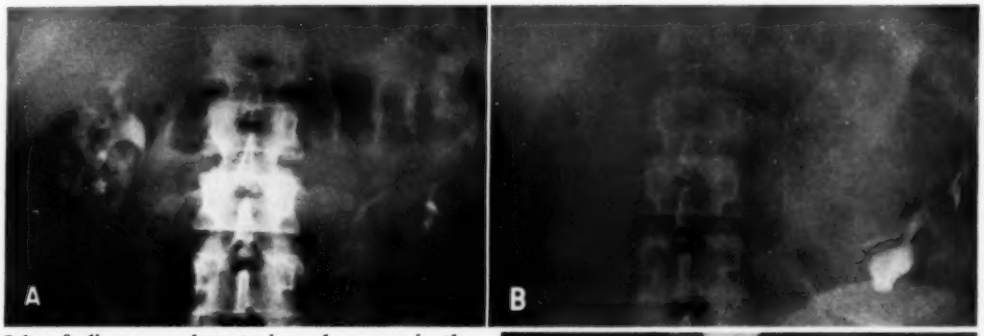
Our investigations in these 17 cases re-

[1] Presented at the Thirty-ninth Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 13–18, 1953.

vealed, surprisingly enough, that 23 per cent of the total number of patients with traumatic rupture of the kidney showed also pre-existing renal disease, of which there had been no knowledge on admission. The conditions encountered included cysts, malignant tumors, hydronephrosis, and calculi. A brief summary of these cases is here presented.

CASE I (Fig. 1): L. C., a 69-year-old man, was struck by a car and was admitted to the hospital with compound fractures of the tibia and fibula and fractures of the right wing of the ilium, the transverse process of the 3rd lumbar vertebra on the right side, and of the 11th and 12th ribs on the right side.

Fig. 1. Case I. Hypernephroma of the right kidney; calculus in left kidney.



Other findings were hematuria and a mass in the right abdomen. A clinical diagnosis of rupture of the right kidney was made. Intravenous pyelography showed a large calculus in a non-functioning left kidney with a suspicious mass in the upper pole of the functioning right kidney. The retrograde pyelogram on the right side presented evidence of hypernephroma. The patient's general condition deteriorated and he died in two weeks. Autopsy confirmed the diagnosis of calculus in the left kidney and hypernephroma of the right. No evidence of any previous kidney disease was obtained either from the patient or from his family in this medico-legal case.

Fig. 2. Case II. Hypernephroma of left kidney. A. On admission for traumatic rupture. B. Three years later. C. Aortogram showing vascular character of the tumor.

CASE II (Fig. 2): H. W., a 56-year-old man, fell while skiing, experiencing immediate severe pain in the left flank. When he was brought to the bottom of the hill on which he had been skiing there was gross hematuria. On hospital admission, a mass was palpated in the left abdomen and intravenous pyelography revealed evidence of hypernephroma on the left side. The patient refused surgical treatment and three years later, on recurrence of hematuria, he was readmitted to the hospital. The tumor had grown, and an aortogram showed it to be vascular. Surgical intervention was again refused.

Two months later the patient returned with low bowel obstruction, and at operation carcinoma of the sigmoid and hypernephroma of the left kidney were found and proved pathologically.

CASE III (Fig. 3): J. D., a 23-year-old semi-professional hockey player, was knocked into the boards during a game. The bump sustained was not unusual, but he felt rather faint. On returning to the dressing room, he passed red urine. He was sent to the hospital immediately, complaining of slight

Fig. 3. Case III. Bilateral renal cysts, with extravasation of the contrast medium into cyst in left kidney.

pain in the flank with hematuria, and a clinical diagnosis of rupture of the left kidney was made. Intravenous pyelography eight hours later showed multiple cysts in both kidneys with extravasation of medium in the cyst in the lower pole of the left kidney. Hematuria continued for one week. Treatment was conservative.

CASE IV (Fig. 4): R. J., a 16-year-old boy, fell off his bicycle and, while he did not feel he had suffered any great injury, he passed bloody urine about ten minutes afterward. An intravenous pyelogram, obtained soon after he had been admitted to the hospital with a diagnosis of a ruptured left kidney, gave evidence of bilateral hydronephrosis, more marked on the left than on the right side. At operation this proved to be due to a fibrous band.

In considering these cases, the question will doubtless arise: Are they not in reality examples of spontaneous rupture of the kidney rather than true cases of traumatic rupture? But, even in spontaneous rupture, there must be some trauma, however small. The fact remains that all of the patients in this group did suffer trauma and as a result were admitted to hospital on a clinical diagnosis of traumatic rupture of the kidney. As has been said, there was no knowledge of a pre-existing kidney condition until it was revealed on urographic examination following injury.

Our experience in the 17 cases reviewed points clearly to the need for adequate radiological examination in cases of traumatic rupture of the kidney. It is true that in the years from 1909 to 1947, 102 patients were examined in our hospital with this clinical diagnosis and only 4 showed pre-existing kidney disease (in each case hydronephrosis); but in only 18 did x-ray examination include anything beyond a plain film of the abdomen. One would hardly expect to find pre-existing disease where radiological investigation was inadequate.

It is still too early to assess the final results of treatment on all 17 patients.

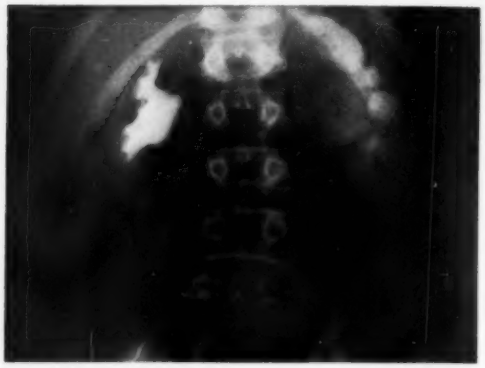


Fig. 4. Case IV. Bilateral hydronephrosis, more marked on the left.

At this date we know that 2 died of other injuries—ruptured liver and spleen and multiple fractures; also 1 patient was operated upon because of hydronephrosis present upon admission to hospital. Nephrectomy was performed on 2 patients because of recurrent hemorrhage. An additional patient underwent nephrectomy because of hypernephroma. Hydronephrosis developed in 1 case following stricture of the ureter. One patient over a period of two years had progressive loss in size and function of the kidney due to interference with blood supply. His history is as follows:

CASE V (Fig. 5): A. Mac., a 24-year-old man, suffered a crush injury to the right abdomen in a car accident, followed by pain in the loin and hematuria, but no mass was palpable. Intravenous pyelography on admission showed non-function of the right kidney but no other abnormality. Four weeks later there was a slight decrease in the size of the non-functioning kidney. Eight weeks after injury function was still absent and there was a further slight decrease in size of the kidney. Nineteen weeks after injury marked decrease in the size of the non-functioning right kidney was apparent on an intravenous pyelogram, while retrograde pyelography showed shortening and clumping of the calyces. The patient was asymptomatic. The blood pressure

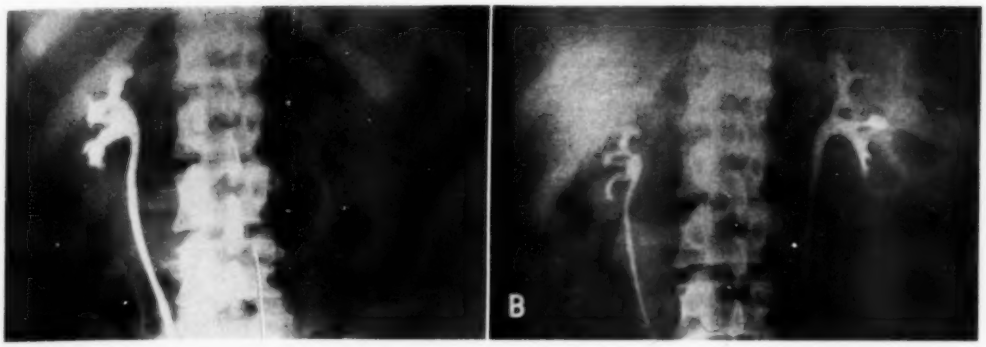


Fig. 5. Case V. A. Retrograde pyelogram of non- functioning right kidney two weeks after crush injury. B. Retrograde pyelogram of same kidney three months later.

was 125/80; non-protein nitrogen 40 mg.; urinalysis negative. At this time indigo carmine injected intravenously was excreted from the left kidney in a three-minute interval but appeared only faintly from the right kidney in ten minutes.

The remaining 9 patients were treated conservatively. Recently 5 returned for re-examination and, while 1 showed a minor degree of shrinkage of one pole of the kidney, all were symptom-free.

CONCLUSIONS

1. Intravenous pyelograms should be obtained in all cases of suspected traumatic rupture of the kidney, preferably on admission.

2. In a small series of 17 cases gathered over a six-year period 23 per cent showed evidence of pre-existing disease.

NOTE: I wish to thank Dr. W. K. Kerr and Prof. David Mitchell of the Department of Urology, Toronto General Hospital, for their kind assistance.

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SUMARIO

Rotura Traumática del Riñón

Repásase una serie de 17 casos de rotura traumática del riñón, observados en el Hospital General de Toronto (Canadá) en un período de seis años. En 23 por ciento, el examen consecutivo al ingreso reveló la preexistencia de una afección renal, comprendiendo quistes, tumores malignos, hidronefrosis y cálculos.

Recálcase la importancia de la pielografía endovenosa para el diagnóstico y como guía para el tratamiento. En 8 de 9 casos de la serie en que se llevó a cabo ese procedimento, aportó información valiosa. Tambiénse obtuvieron pielogramas retrógrados en 5 casos, facilitando en 2 de éstos nuevos datos en cuanto al estado del riñón.

DISCUSSION

Jean Bouchard, M.D. (Montreal, Canada): I believe that Dr. Hall has brought to the fore a very important problem on which it is ordinarily rather difficult for any single radiologist to collect an adequate amount of data or information.

A review of his series of 17 cases is certainly striking in that he observed that 23 per cent of these patients had previously damaged kidneys. Of his earlier group of cases—the 102 seen in the Toronto General from 1909 to 1947, only 18 had x-

ray investigation, and 4 of these showed evidence of previous damage to the kidney. If one works out the percentage, it is found to be 22 per cent of the group adequately examined. It would seem, therefore, that the incidence of previous damage to the kidney as a predisposing factor to traumatic rupture is probably in the neighborhood of 20 to 25 per cent.

I do not think that anyone can be certain as to what is the best method of investigation in suspected traumatic rupture of the kidney. That can be argued back and forth, but it seems to me that excretory pyelography is the most conservative and probably the most accurate method because it gives information at once on both kidneys. I believe it should be the method of choice.

As to retrograde pyelography, it should be utilized as a measure of investigation only if immediate surgery is considered and if the two kidneys are going to be examined at the same time; otherwise there would be the danger of missing important findings which would probably modify the approach.

I believe, also, that retrograde pyelography combined with the excretory method has a definite place for follow-up purposes in order to obtain the best demonstration possible of the degree of morphological recovery of the ruptured kidney.

In conclusion, I think Dr. Hall must be complimented for bringing up a very interesting subject and also stressing some points which are of interest and practical value in both diagnosis and treatment.

Roentgenologic Manifestations of Lymphosarcoma of the Small Bowel[1]

PAUL H. DEEB, M.D., and WALTER L. STILSON, M.D.

ALTHOUGH GENERAL or multicentric lymphosarcoma is well known, focal or unicentric lymphosarcoma has only recently become well understood. Ackerman and del Regato (1) in their textbook on cancer state: "Lymphosarcoma is often seen first as a generalized process, but a certain unknown but *increasing* proportion of cases has been reported with a definite focus of origin. Regato (1939) reported that lymphosarcoma frequently arose from the region of Waldeyer's ring (nasopharynx, tonsil, base of the tongue). The second most common location is from the gastrointestinal tract, from the stomach, large bowel or small bowel." Sugarbaker and Craver (11), reviewing 196 proved cases of lymphosarcoma, found that 5.5 per cent arose in the digestive tract, over half of these having their origin in the stomach. One-third of their series appeared to arise primarily outside the lymphatic system. Such extra-nodal involvement appears to be worthy of attention. The roentgen manifestations of lymphosarcoma of the stomach have been reviewed by us in a previous paper (5). Here we shall confine ourselves to the manifestations in the small intestine.

INCIDENCE

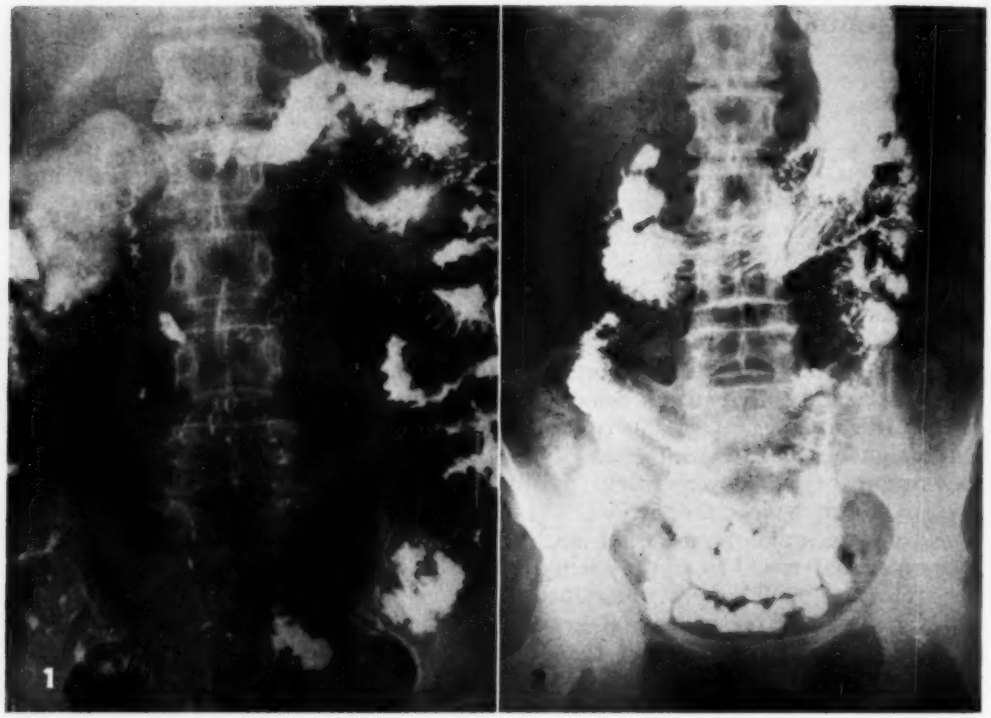
The exact incidence of lymphosarcoma of the small intestine is not known. Berman and Mainella (2), in 1945, quoted Charache as saying that he knew of 404 cases of intestinal lymphosarcoma. Menne, Mason, and Johnston (8) found 2 examples in 40,000 pathological examinations. Their review of the literature in 1942 yielded only 376 authentic cases of lymphosarcoma of the small intestine. Feldman (6) collected 58 cases of sarcoma of the small bowel from 104,621 necropsies.

Lymphosarcoma has been reported in all parts of the intestinal tract. In the small bowel, the ileum is the most common site and the duodenum the least common. This incidence appears to parallel the richness of the lymphatic tissue in the gut. Lesions have been reported in the colon, especially in the rectal region. Most of the patients have been in the earlier decades of life, especially between the ages of twenty and forty (13). Cutler, Stark and Scott (4) feel that a neoplasm of the intestinal tract in an infant or child should be regarded as lymphosarcoma until proved otherwise.

ROENTGEN MANIFESTATIONS

In 1932 Ullman and Abeshouse (12) reported a case of lymphosarcoma of the ileum found unexpectedly during an operation for removal of the appendix. This lesion took the form of an annular constricting ring in the terminal ileum 12 cm. from the ileocecal valve, and was accompanied by two abscesses in the adjacent mesentery. These writers felt that an annular growth was the most common manifestation of the disease in the intestine and that symptoms and roentgen findings would be predominantly those of obstruction. This was true in Case IV of the series to be reported here. Present (9) in 1939 reported 2 cases of primary lymphosarcoma of the duodenum in which the roentgen findings were destruction and obliteration of the mucous membrane pattern, stiffening of the walls, and absence of peristalsis. McSwain and Beal (7) consider a palpable mass, especially a large one in a patient in good condition, to be suggestive of lymphosarcoma of the intestine. In 1 of the 2 cases reported by Menne, Mason, and Johnston, the roentgenogram showed

[1] From the Department of Radiology, College of Medical Evangelists, and White Memorial Hospital, Los Angeles, Calif. Presented before the California State Medical Association, in Los Angeles, May 25, 1953. Accepted for publication in August 1953.

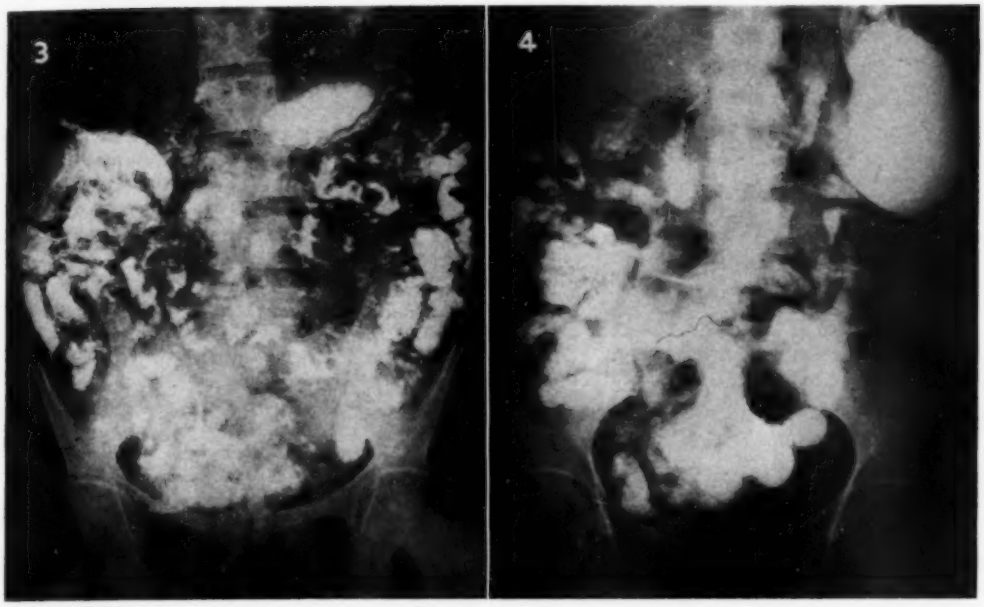


Figs. 1 and 2. Case I. Fig. 1 shows a distorted small bowel pattern with thickened valvulae conniventes and nodular impressions. Following irradiation the mucosal pattern returned to normal and remained so several years later (Fig. 2).

dilatation of the terminal 8 inches of the ileum, suggesting partial obstruction. The mucosa in this area was mottled, and the patient was operated on under the diagnosis of regional ileitis. Histologic examination indicated lymphosarcoma. The second case showed only signs and symptoms of obstruction.

Chont (3) believed that a small bowel study should determine the origin and probably the type of the lesion. He presented the case of a 46-year-old woman with severe pain and weight loss and a palpable mass in the left abdomen. Roentgen examination showed a widened segment of jejunum just below the ligament of Treitz, measuring 15 cm. The wall was rigid. The medial contour was smooth and without evidence of normal mucosal pattern. Several defects in the lateral contour of the segment and a large circular defect at the lower pole were found. Below this, the small intestine was normal. The widened segment retained barium for some time, though there was no retention above it. The loops were fixed and immovable on palpation. Chont felt that the findings were indicative of a *tumor of the proximal segment of the small intestine*, with extension into the supplying mesentery, and suggested lymphoblastoma, a diagnosis which was confirmed at surgery. He mentioned "radiation biopsy" with delivery of 200 r of deep roentgen radiation, as a therapeutic test. Recognizable diminution of the mass within 72 hours would indicate lymphosarcoma.

Shulman (10), in 1941, described the roentgen findings in a patient with extensive primary lymphosarcoma of the jejunum. The proximal coils of the jejunum showed a very bizarre appearance. The normal mucosal pattern was entirely lost. Long segments of dilated small bowel were interspersed with constricted seg-



Figs. 3 and 4. Case II. Fig. 3 shows obliteration of the normal mucosal pattern in the entire small bowel area and nodular defects in the upper jejunum. Some improvement followed roentgen therapy but within four months there was evidence of recurrence (Fig. 4).

ments. The areas of constriction showed smooth, concave defects along the walls as if from compression by nodular masses. There was delay in passage of the barium through the coils. At surgery the proximal jejunum was found to be infiltrated by numerous discrete nodular masses, and the adjacent mesentery contained markedly enlarged lymph nodes. This diffuse lymphosarcoma of the small-cell type was controlled by intensive radiation therapy. The patient died five months later from peritonitis, but autopsy revealed no lymphosarcoma.

CASE REPORTS

CASE I: L. H., female, age 43, was seen in the White Memorial Clinic in July 1946 with swelling of the abdomen of eight months duration, vomiting for six months, liquid stools for two months, restlessness at night for one week, and weight loss. Abdominal examination revealed several large, firm masses, the majority in the upper left abdomen. These were attached deeply. Following radiologic examination (see below), the patient was referred to the Tumor Board, which suggested a diagnosis of tuberculous peritonitis or carcinoma of the ovary with metastasis and advised laparotomy. This was done July 17, 1946. At the base of the mesentery was a 20 × 20 cm. mass 5 or 6 cm. thick. Subserous, raised tubercle-like lesions were seen at the mesenteric border of the bowel. Most of the mesenteric lymph nodes were involved. *Pathological diagnosis:* lymphosarcoma.

Small doses of radiation therapy were given, an average of 500 r to each of four abdominal portals, from July 23 to August 14, 1946, and again in September 1946. The masses disappeared and the patient felt quite well. Small series were again given in 1948 and in 1950. When the patient was last seen, in January 1953, there was no evidence of disease.

Interval roentgen studies of the small bowel (Fig. 1) showed the mucosal pattern of the jejunum to be markedly altered, with thickened valvulae conniventes and nodular impressions. There was no evidence of destruction of the mucosa. The barium was scattered in an abnormal manner. The appearance suggested the so-called deficiency pattern. Examination made six months later, after radiation treatment, showed restoration of the jejunal pattern to normal, and this was confirmed in 1952 (Fig. 2).

CASE II: L. P., female, age 27, was seen at the White Memorial Clinic in August 1945, with a history of diarrhea alternating with constipation for ten years. Four years before admission the diarrhea became more severe, with ten to fifteen yellow-brown stools daily, associated with cramping. No gross blood or tarry stools were reported, although in May

Fig. 5. Case III. Six-hour film showing bizarre pattern in the small bowel, indicating neoplastic involvement.

1945 microscopic blood (+1) was found. In the past two or three years ankle edema had developed. The patient had experienced epigastric and right upper quadrant pain for three years, relieved by food. She had never been outside the continental United States. A blood study in May 1945 revealed 12,400 white blood cells, with 38 per cent polymorphonuclears, 36 per cent lymphocytes, 7 per cent monocytes, 2 per cent eosinophils, 4 per cent stab cells, 2 per cent young forms. Numerous stool studies failed to reveal pathogenic bacteria or parasites.

Laparotomy on Sept. 21, 1945, revealed a peculiar nodularity throughout the entire small bowel, especially the upper jejunum and lower duodenum, most marked at the mesenteric border. The mesenteric lymph nodes were enlarged and there were evidences of cirrhosis in the liver and free peritoneal fluid. Biopsies were reported as showing lymphadenitis of a mesenteric lymph node, probable lymphosarcoma of the intestinal mucosa, and cirrhosis of the liver. Small doses of radiation therapy to the abdomen in September, October, and November 1945, and in February and April 1946, met with a temporary response, but the patient went down hill and died on April 13, 1946.

Radiologic examination showed obliteration of the lowermost mucosal folds of the duodenum and irregularity of the walls. Interval films of the small bowel (Fig. 3) demonstrated marked changes. Several round filling defects were noted in the upper jejunum, from 1 to 2 cm. in diameter, and the normal mucosal pattern was completely obliterated in the entire small bowel area. All folds were markedly thickened, and many loops appeared to be rigid. The roentgen conclusion was "unusually extensive and marked changes in the whole small intestinal tract, suggesting lymphosarcoma of the bowel." Roentgenograms obtained after the initial course of radiation showed improvement in the intestinal pattern but within four months there was evidence of recurrence (Fig. 4).

CASE III: This case is mentioned here not because it is primarily a lymphosarcoma of the small intestine but because the x-ray findings in the small bowel were similar to those in the above cases.

W. H., male, age 72, had cervical adenitis on the left side, which regressed rapidly following x-ray therapy. No positive biopsy was obtained. The six-hour gastrointestinal film (Fig. 5) revealed the bizarre pattern in the small bowel seen in the other cases. There was also roentgen evidence of lymphosarcoma of the stomach. These manifestations have been reported previously (5). Death occurred from the disease within three months.

CASE IV: M.P., female, age 35, had symptoms suggesting appendicitis in 1942. In doing an appendectomy the surgeon (Dr. Truman) found a milky fluid in the abdomen with some nodules on the peritoneal surface. A biopsy of one of these nodules was reported as "lymph node." In September 1943, severe backache and pain in the left lower abdomen developed. An exploratory operation on Oct. 14 disclosed a mass, about 8 cm. in diameter, involving the entire mesentery. The mass was solid and a small amount of milky fluid was expressed. The abdomen contained about 6 ounces of sanguineous fluid. The biopsy report was "lymph node without evidence of malignancy." Examination of the ascitic fluid showed lymphocytes. X-ray studies made before the surgery had indicated no evidence of disease in the stomach or colon. These films were not available for review.

The patient entered the White Memorial Hospital on Oct. 19, 1943, complaining of symptoms of bowel obstruction for one week. Because of the peculiar operative findings two weeks earlier, a clinical diagnosis of lymphosarcoma was made and radiation treatment was begun. In fourteen days 600 r was given to each of four abdominal portals, two anterior and two posterior. The symptoms did not abate, and laparotomy was performed Nov. 2. A knuckle of bowel was found to be bound down, producing obstruction. This knuckle was short-circuited and another biopsy taken, which was finally reported as lymphosarcoma of the mesentery. Beginning one month later, over a period of about a month, the patient was given an additional 1,200 r to each of four abdominal portals as before. She improved rapidly and continued well until 1946, when another abdominal mass appeared. Despite the previous irradiation to the abdomen, the patient had become pregnant. Abortion occurred, with a dead fetus.

Following this episode, the patient remained well for about six years. She was next seen in February 1952, complaining of aching in the right shoulder since July 1951 and marked limitation of motion for the past three months. X-ray examination revealed extensive destruction of the acromion process and the blade of the scapula. A needle biopsy of this area was reported as "probable lymphosarcoma." From Feb. 29 to May 12, 1952, the patient was given a tumor dose of approximately 2,800 r to the shoulder. Pain was completely relieved and recalcification of the bone was demonstrated roentgenologically. The patient was last seen in April 1953, apparently free of disease.

COMMENT

The first 3 patients in this series had multiple involvement of the small intestine. The findings agree with those described by Shulman (10) and undoubtedly are due to the presence of lymphocytic infiltration into the mesenteric lymph nodes and the lymph channels within the bowel walls. The roentgen appearance is similar to that of regional enteritis, non-tropical sprue, and motor dysfunction. In general, however, the presence of multiple marginal nodular defects helps to differentiate lymphosarcoma from these other lesions. When one has such bizarre small bowel changes as have been described, lymphosarcoma should surely be considered.

The fourth case is an example of primarily obstructive symptoms. Unfortunately, we do not have films illustrating the obstruction, but the patient did have a lymphosarcoma which produced obstruction and which was treated by radiation therapy. She remained free of symptoms for eight years. Lymphosarcoma of the scapula then developed, and this, too, responded to radiation.

Two patients in this group, with lymphosarcoma of the mesentery and small bowel, have been free of disease for more then seven years.

SUMMARY AND CONCLUSION

1. Lymphosarcoma occurring as a primary process in the small bowel should be more frequently considered in differential diagnosis.

2. The roentgen appearance may be described as resembling motor dysfunction, with the following characteristics: destruction and obliteration of the mucous membrane pattern; "stiffness" of the walls and absence of peristalsis; crescentic indentations due to small lymphosarcomatous infiltrates; in some cases the picture is only that of intestinal obstruction; occasionally abdominal masses are palpable; rapid disappearance of roentgen findings follows radiation therapy.

3. In 2 of 4 reported cases of lymphosarcoma of the small bowel, there was freedom from symptoms more than seven years after radiation therapy.

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(*Para el sumario en español, véase la página siguiente.*)

SUMARIO

Manifestaciones Roentgenológicas del Linfosarcoma del Intestino Delgado

El linfosarcoma que tiene su asiento primario en el intestino delgado debe ser considerado más frecuentemente en el diagnóstico diferencial de las afecciones del tubo intestinal. Las características roentgenológicas comprenden deformación y obliteración del patrón de la mucosa, "rigidez" de las paredes intestinales y falta de peristaltismo, múltiples indentaciones semilunares debidas a pequeños infiltrados linfosarcomatosos. En algunos casos, el cuadro es puramente de oclusión intestinal. A veces, las tumefacciones abdominales son palpables. La roentgenoterapia conduce a rápida desaparición de las alteraciones radiográficas.

Preséntanse 4 casos, 3 con invasión múltiple del intestino delgado y 1 de linfosarcoma del mesenterio que producía síntomas de obstrucción. Dos de los enfermos estaban sin síntomas al cabo de más de siete años de la radioterapia.

Double Contrast Study of Colon: Routine Lateral Recumbent View[1]

JOSEPH C. ROOT, M.D., and CHARLES M. GREENWALD, M.D.

THE DIFFICULTIES and pitfalls involved in identifying small polypoid lesions of the colon by means of double-contrast enema are well recognized. The medical literature contains a considerable number of articles concerning various technics of preparation, examination, and positioning, including such innovations as dilute barium (1) and high-voltage radiography (2). It is the purpose of this article to re-emphasize the diagnostic usefulness of routine left and right lateral decubitus views as part of the survey procedure.

The use of the horizontal beam is as old as air-contrast study itself. Fischer (3), in 1925, was the first to describe a satisfactory method, and as part of that initial technic he examined his patients in the upright and lateral decubitus positions, preferring to use a horizontal beam. Weber (4) and Gershon-Cohen (5), the early exponents of the double-contrast study in this country, used primarily the vertical beam for their survey films, with certain other modifications of Fischer's method. The need for multiple views was recognized early because of poor visualization due to overlapping coils of bowel, and the desirability of reproducing questionable changes in more than one projection. The commonly described views include anteroposterior and postero-anterior, which are often taken stereoscopically, the obliques, and Trendelenburg. For all these projections a vertical beam is used. It is our belief that not enough emphasis has been placed on use of the horizontal beam.

Polgar (6), one of the more recent advocates of the horizontal beam, recommends performance of both the regular barium enema and air study in the recumbent position. He describes the convenience of this method in terms of ease of technical procedure and the use of local air filling in segmental evaluation, but he does not sufficiently stress the diagnostic superiority of total colon survey films in this position over those obtained with the more commonly employed vertical beam.

Our procedure of double-contrast examination is as follows: The patient is scheduled at least two days in advance, so that he may be placed on a low-residue diet for forty-eight hours prior to study. He is given a mimeographed diet sheet and instructions and is advised of the importance of carefully following them. Institution of the low-residue diet has resulted in noticeable improvement in the degree of cleanliness of the bowel, and has proved particularly useful in evaluation of the right colon.

One ounce of castor oil is taken at four o'clock the afternoon prior to examination; 2 ounces are given if the patient is in the habit of taking laxatives. Use of the low-residue diet allows the patient to continue his meals, there being no elimination of either the evening meal or breakfast prior to examination. In the mid-morning, tap-water enemas are taken until the return is clear. The enema tip is lubricated with soap rather than vaseline.

Contrast study is performed in the early afternoon. The one-stage method is the procedure of choice, with the barium enema apparatus and air insufflator connected by a Y tube to the rectal tip. Our technic is essentially the same as that described by Moreton, Cooper, and Foegelle (7). Barium and air are administered, with fluoroscopic control at all times, and spot films are taken as indicated.

Following fluoroscopy, six films are routinely obtained. The first group of three are made with the vertical beam and comprise postero-anterior, anteroposterior,

[1] From the Department of Radiology, the Cleveland Clinic Foundation, and the Frank E. Bunts Educational Institute, Cleveland, Ohio. Accepted for publication in August 1953.

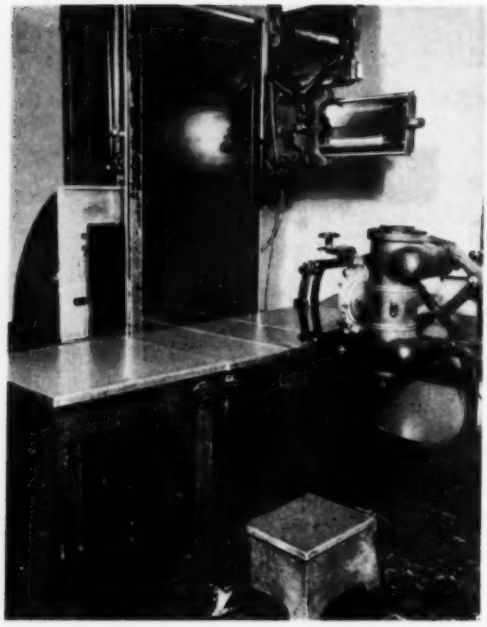

Fig. 1. Standard equipment arranged for obtaining decubitus views. A fluoroscopic unit is tilted to 90 degrees, and a wheeled table is placed in front of it.

and left posterior oblique views. The patient then goes into an adjoining room and lies recumbent on a table placed against a standard fluoroscopic table tilted vertically to 90° (Fig. 1), and left and right decubitus views are obtained, with the Potter-Bucky diaphragm. If two rooms are not readily available, the entire study can be carried out on a single unit, with only the slight delay involved in tilting the fluoroscopic table upright after the first group of films are made. A cart is placed in front of the table and the decubitus views are obtained. The patient is then allowed to empty the colon, and a final postero-anterior roentgenogram is taken.

The superiority of the decubitus films over the more conventional views is apparent in a review of all roentgenologically demonstrated polypoid lesions surgically removed at the Cleveland Clinic since 1950. There was no lesion seen on any of the vertical beam projections that was not also demonstrated on at least one of the decubitus views. In the majority of instances, the diagnostic quality of the latter films was considerably better and the lesions were more clearly apparent. More important, there were a number of instances in which minimal changes that might easily have been overlooked with the vertical beam were shown on the decubitus films to represent definite intraluminal defects. Jones, Kaplan, and Windholz (8) offer further confirmation of this. They discarded the use of prone and supine views, since these were found of little additional value as compared to a survey group in which were included an erect postero-anterior, right and left lateral decubitus, and postero-anterior Trendelenburg projections.

We find the decubitus views of particular value in study of the redundant sigmoid, where overlapping loops make it difficult to be sure that total visualization has been achieved. When fluid levels may obscure the left portion of all the loops of sigmoid in the left decubitus, the right portion is well outlined. As long as the amount of fluid is relatively small, and occupies less than one-half of any loop, good total visualization is obtained with combined use of the two views. Figure 2 illustrates the multiple fluid levels, and their shift in position on the left and right decubitus views as seen in a normal double-contrast study.

Two cases demonstrating polypoid lesions hidden on conventional views are presented.

CASE I: W. H. Z., a 62-year-old man, entered the Clinic complaining of intermittent loose stools for eight years. Diarrhea had been almost constant for six to eight months, with occasional passage of blood and mucus. The blood was mixed with the stools. Barium enema revealed a questionable sigmoid defect. Double-contrast study showed a somewhat redundant sigmoid, poorly visualized except on the decubitus films. The latter clearly demonstrated a 1.5-cm. polypoid defect on a stalk, with shifting of the lesion in accordance with the gravitational effect of the decubitus positions (Fig. 3). Proctoscopy confirmed the presence of the polyp, which was removed from the distal sigmoid by transcolonic polypectomy. The lesion proved to be a papillomatous polyp 1.4 cm. in diameter on a 5-cm. stalk.

Fig. 2. Left (A) and right (B) decubitus views of a normal double-contrast study. The multiple fluid levels are well demonstrated, and combined use of the two films affords good total visualization of the entire colon, particularly the redundant sigmoid.

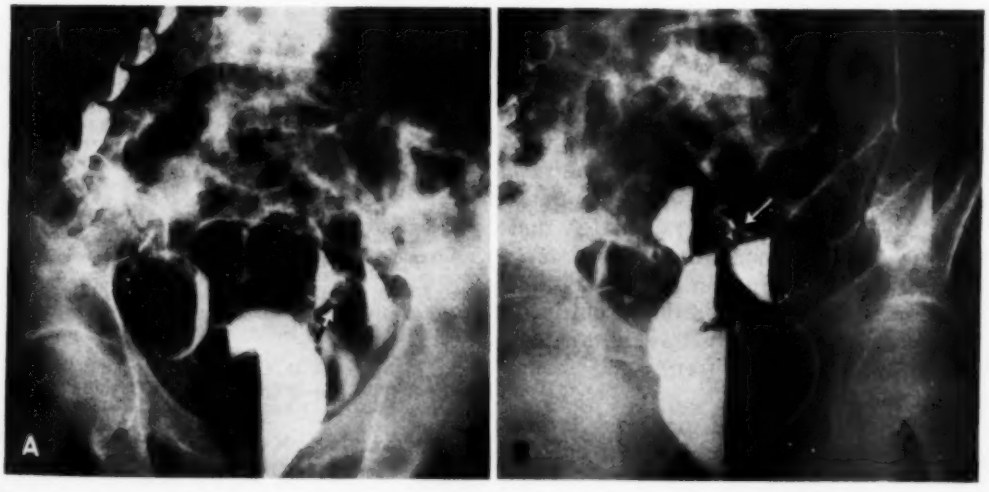

Fig. 3. Case I. Left (A) and right (B) decubitus views showing a redundant sigmoid colon containing a solitary polyp on a long stalk.

CASE II: A. C. S., a 60-year-old woman, was seen at the Clinic complaining of blood mixed with the stools for the past four months. She was asymptomatic, with no change in bowel habit. Proctoscopy and a barium enema study were negative. Air-contrast examination revealed a rounded shadow at the junction of the descending and sigmoid colon, equivocal in nature on all but the decubitus films.

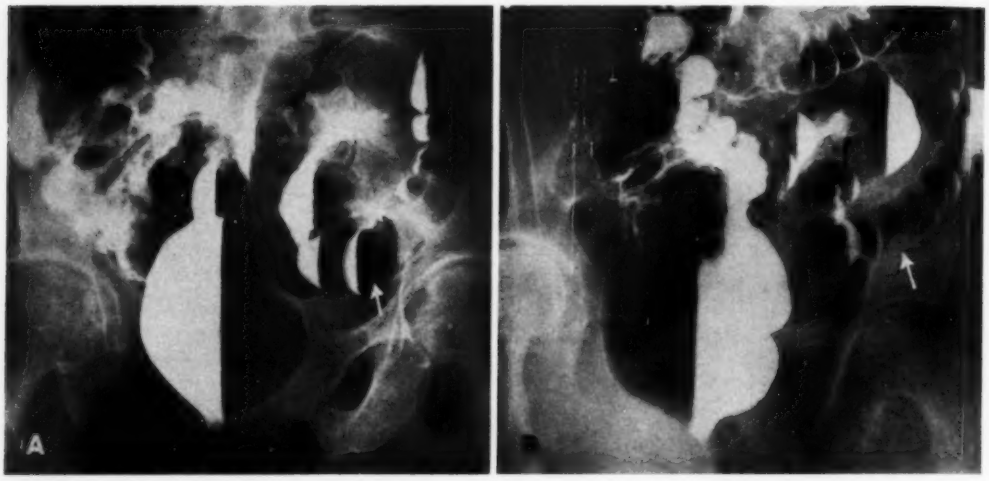

Fig. 4. Case II. Right (A) and left (B) decubitus views revealing a polyp in the distal sigmoid. Its short stalk is unusually well demonstrated in the right decubitus position, with the polyp hanging free in the lumen.

These showed a definite polypoid lesion, the short stalk of which was unusually well demonstrated. On the left decubitus film the polyp lay flattened against the bowel wall, while on the right decubitus film it hung free in the lumen (Fig. 4). Transcolonic polypectomy was performed, with removal of a 1.5-cm. papillomatous polyp attached by a 0.7 cm. stalk to the mesenteric side of the sigmoid in its proximal quarter.

SUMMARY

1. The diagnostic superiority of horizontal-beam survey films in the decubitus position over the more conventional vertical-beam studies used in double-contrast enema examinations is discussed. The quality of the films is, in general, better, and lesions can be demonstrated which may otherwise escape detection.

2. A method of preparation is outlined, an important part of which is the use of a low-residue diet for forty-eight hours prior to examination.

3. Two examples of polypoid lesions well demonstrated only on the decubitus films are presented.

4. Routine use of the left and right decubitus views as a survey procedure is recommended.

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SUMARIO

Estudio con Doble Contraste del Colon: Vista Recostada Lateral Corriente

Las radiografías obtenidas con doble contraste del colon con el enfermo en decúbito y usando un haz horizontal han resultado superiores para diagnóstico a los estudios más convencionales de doble contraste con un haz vertical. El uso sistemático de vistas en decúbito izquierdo y derecho ofrece un reconocimiento completo del colon.

La calidad diagnóstica de las radiografías obtenidas de ese modo es en general mejor, y pueden descubrirse así lesiones que de otra manera eludirían la observación.

Descríbese a fondo el procedimiento de los AA. Una característica importante consiste en el consumo de un régimen alimenticio de residuo bajo durante cuarenta y ocho horas antes del examen.

Asymmetrical Widening of the Coronal Suture Secondary to an Infected Subdural Hematoma[1]

ELMER G. ST. JOHN, M.D.

Separation of the cranial sutures in the presence of increased intracranial pressure in children is often seen. Unilateral separation, however, is rare. The author has been unable to find in the available literature any reference to asymmetrical widening of a cranial suture secondary to infection.

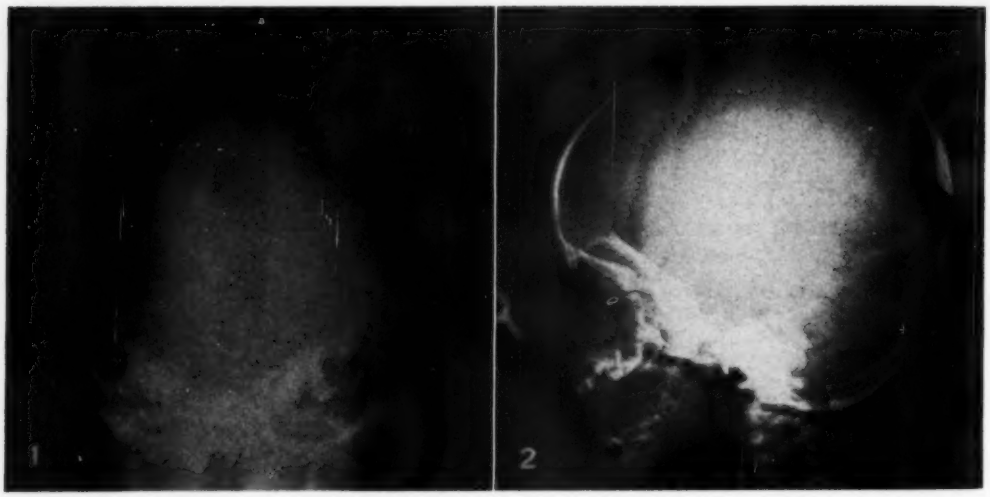

Fig. 1. Occipital view of the skull showing marked separation of the left half of the coronal suture. Some widening of the sagittal suture is also present.

Fig. 2. Right lateral view of the skull showing widening of the left half of the coronal suture. A small but relatively insignificant amount of distortion is present because of the increased distance of the left side of the skull as compared to the right.

CASE REPORT

A 7-month-old white boy was admitted to the hospital because of sudden onset of vomiting and fever during the previous night. The positive physical findings consisted of bulging of the anterior fontanel, nuchal rigidity and a vacant stare, with a tendency of the eyes to drift to the right. The admission temperature was 104° F. (rectal) and the pulse rate was 140 per minute. The white blood count was 14,800 with 80 per cent lymphocytes. Two days later it was 32,000, with 50 per cent lymphocytes. A lumbar puncture done on the day of admission was normal.

Eight days following admission a needle was easily introduced through a thinned-out, bulging portion of the calvarium on the left, and 100 c.c. of light brown fluid was obtained. Three days later incision and drainage of a left frontoparietal chronically infected subdural hematoma were done. The left portion of the temporoparietal suture, when exposed, was found to be separated. The fibrous tissue at the separation was incised, and the dura was dissected free from the overlying skull. No epidural infection was found. The dura was then incised. Beneath it was observed a membrane 4 cm. thick, which, on incision, led into a subdural abscess, 5 cm. in diameter and 3 cm. in depth. A specimen sent to the department of pathology was reported as showing old blood clot and a small amount of inflammatory exudate. Hemolytic *Staphylococcus albus* was cultured from the lesion.

Roentgenograms of the skull taken on the child's admission to the hospital, demonstrating the marked separation of the left half of the coronal suture, are shown in Figures 1 and 2. Postoperative pneumoencephalograms obtained six weeks later are reproduced in Figures 3 and 4.

[1] From the Department of Radiology, Binghamton City Hospital, Binghamton, N. Y. Accepted for publication in August 1953.

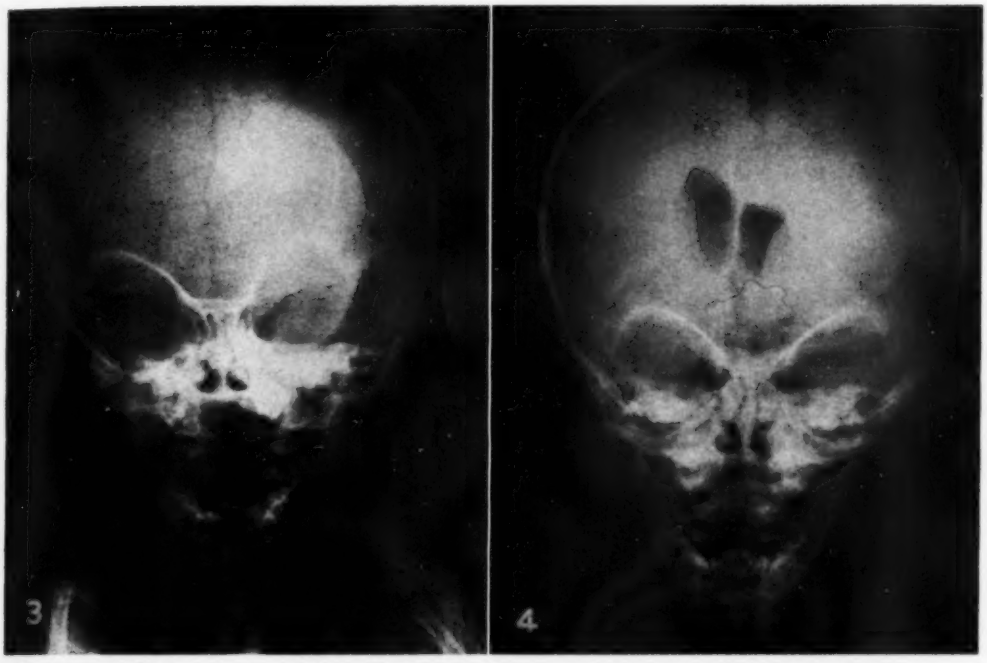

Fig. 3. Frontal view showing bulging and thinning of the cortex at the site of pointing of the abscess.
Fig. 4. Encephalogram showing displacement of the ventricular system to the right and the depression of the roof of the left lateral ventricle.

DISCUSSION

This case is one of unilateral widening of the coronal suture secondary to an infected subdural hematoma. Unilateral separation of a suture is not uncommonly seen following trauma with depression of a fragment adjacent to a suture. Infected subdural hematomas often cause bulging and thinning of the calvarium overlying the lesion. In this case the lesion lay beneath the left portion of the coronal suture causing its separation.

SUMMARY

A case of unilateral widening of a cranial suture secondary to a chronically infected subdural hematoma is presented.

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SUMARIO

Ensanchamiento Asimétrico de la Sutura Coronal Secundario a Hematoma Subdural Infectado

A un lactante de siete meses se le observó a continuación de un acceso de vómitos y fiebre la noche anterior. Notóse una zona de abultamiento y adelgazamiento a la izquierda del calvario que, según se descubrió, se sobreponía a un absceso subdural infectado crónicamente. La lesión quedaba debajo de la porción izquierda de la sutura, ocasionando la separación de ésta.

No se ha podido descubrir en la literatura ningún otro caso de ensanchamiento unilateral de una sutura craneal secundario a infección.

Coarctation of the Aorta with Regression of Rib Notching Following Surgery[1]

Report of a Case

MALCOLM D. JONES, M.D., and HOWARD L. STEINBACH, M.D.

THE NOTCHING of the inferior aspect of the ribs as a result of pressure from the tortuous vessels of the collateral circulation in coarctation of the aorta is one of the best known diagnostic signs in medicine. Since the advent of improved surgical technics, the operation for correction of the coarctation has become increasingly common. Consequently, opportunity is now available to follow this and other diagnostic signs in the postoperative stages. A case is presented here in which the coarctated segment was resected and x-ray examination one year later showed improvement in both the sharp angular and smooth broad types of rib erosion.

CASE HISTORY

A white male, age 14 years, was admitted to the University of California Medical Center Outpatient Department on Aug. 20, 1951, with a diagnosis of coarctation of the aorta made by the referring physician. The early history revealed only that a cardiac murmur had been heard at the age of five years. At ten years, there was hypertension in the arms, but the blood pressure in the legs was not measured.

Physical examination on admission showed excellent general physical development. Arterial pulsations in the neck were forceful. The blood pressure in the right arm was 180/100, left arm 160/100, right leg 90/0, left leg 80/0. The lungs were clear. Examination of the heart revealed no evident cardiac enlargement to percussion, regular sinus rhythm, and a loud, slapping aortic second sound. A harsh systolic murmur was audible at the left 2nd and 3rd intercostal spaces, transmitted through to the back. No pulsations could be felt in the lower extremities. The remainder of the physical examination was within normal limits.

X-ray examination of the chest, on Aug. 27, showed notching of the inferior aspects of the 2nd through the 8th ribs (Figs. 1A, 2A, 3A). The cardiac contour and the lungs were not remarkable.

On Oct. 3, 1951, surgery was carried out. Coarctation of the aorta was found immediately distal to the take-off of the left subclavian artery at the level of the ligamentum arteriosum. The diameter of the aortic lumen at this point was about 1.0 mm. Proximal to the coarctation the diameter was definitely less than distal to it. The subclavian artery was large, and the internal mammary artery was particularly large. The intercostal collaterals were providing the blood supply to the distal aorta. The coarctated segment was excised and an end-to-end anastomosis between the proximal and distal aortic segments was accomplished. Postoperative recovery was uneventful. The blood pressure in the right arm was 170/110 following surgery, and good femoral pulsations were present.

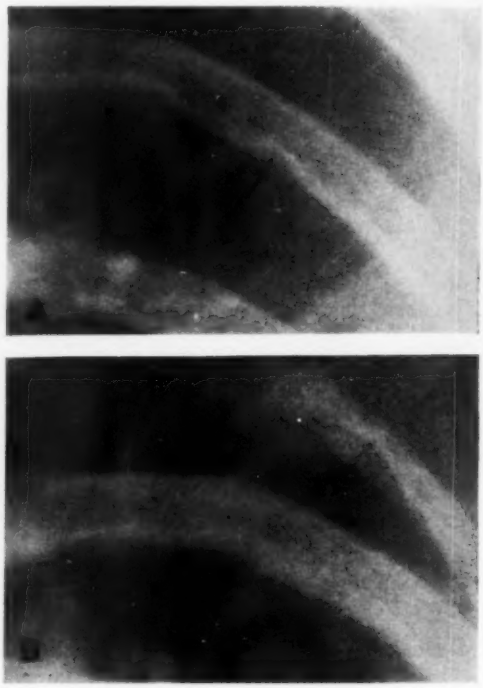

Fig. 1. A. Notching of the inferior aspect of the left sixth rib.
B. Regression of notching after resection of the narrowed segment of the aorta with end-to-end anastomosis thirteen months after operation. The left fifth rib shows regrowth after surgical resection.

[1] From the Department of Radiology, University of California School of Medicine, San Francisco, Calif. Accepted for publication in August 1953.

One year following surgery the blood pressure in the right arm was 150/95, in the left arm 130/95, in the right leg 145/100, and in the left leg 145/110. The supraclavicular vessels were prominent, and their pulsations were felt. A systolic murmur could be heard over the precordium. Excellent femoral pulsations were present. X-ray examination of the chest at this time showed good regrowth of the resected left 5th rib (Fig. 1B) and definite improvement in the notching of the other affected ribs (Figs. 2B and 3B).

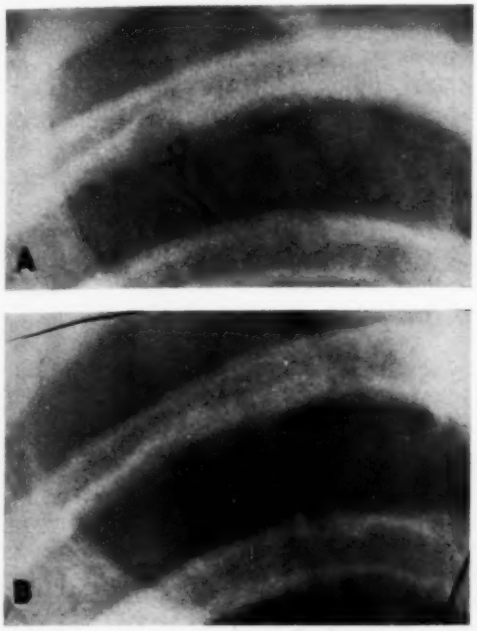

Fig. 2. A. Deep notching of right fourth rib.
B. Regression of the notching thirteen months after resection of the narrowed segment of the aorta with end-to-end anastomosis.

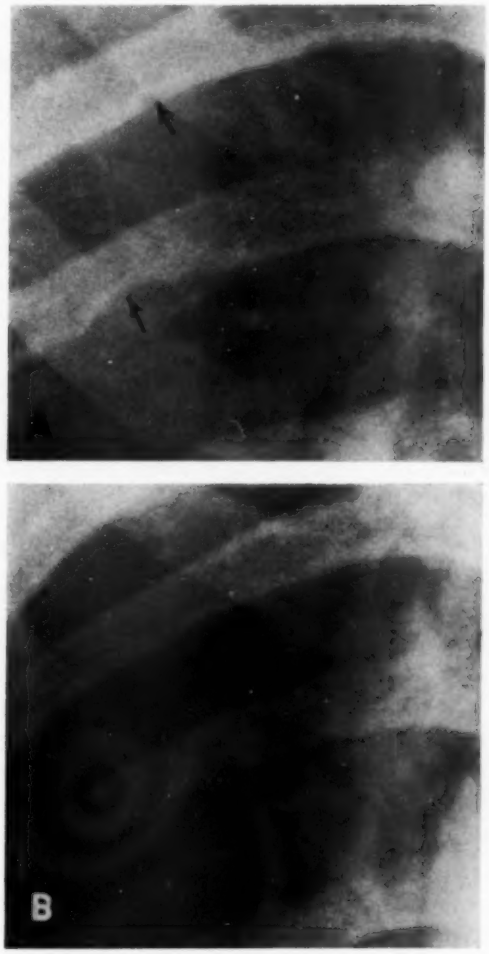

Fig. 3. A. Notching of the interior aspect of the right seventh and eighth ribs.
B. Regression of the notching thirteen months after resection of the narrowed segment of the aorta with end-to-end anastomosis.

DISCUSSION

It is chiefly the posterior intercostal arteries that become dilated and tortuous in the presence of coarctation of the aorta, inasmuch as they are the principal collateral pathways. The resulting pulsations produce the notching of the inferior aspects of the ribs. This is a slow process, and the degree of notching will depend on the extent of narrowing at the area of coarctation and the age of the individual when first examined. While this sign is seldom apparent before the age of twelve to fourteen years (1), a case has been seen in this clinic in which notching from a proved coarctation occurred at the age of eight.

It may be postulated that healing of the notching would be more likely to occur in those cases in which end-to-end anastomosis of the aorta can be accomplished than in those in which the alternative anastomosis between the subclavian artery and the aorta is effected. In the latter operation, the flow, in essence, is through a secondary collateral channel, the primary collaterals

having their origin proximal to the anastomosis. This results perhaps in a greater residual flow through the primary collateral channels which have developed. In the former operation, as done in the case described above, there is re-establishment of the normal course of flow, with consequent loss of dependence upon collateral circulation. This permits regression of the size of the collateral channels and allows for regrowth of the eroded bone.

A second patient, also fourteen years of age, with coarctation of the aorta and a similar type of operative repair, has come under our observation. In this instance, however, the notching was minimal originally and does not lend itself to photographic reproduction.

SUMMARY

A patient with coarctation of the aorta showed definite improvement in rib erosion one year after resection of the narrowed segment with end-to-end anastomosis. It is felt that this is the result of the potential for regeneration of bone in this age group and evidence of an excellent operative result, with return of blood flow to the normal channel so that there is no longer dependence upon the collaterals for distal aortic blood supply.

University of California Medical Center
San Francisco 22, Calif.

REFERENCE

1. TAUSSIG, H. B.: Congenital Malformations of the Heart. New York, Commonwealth Fund, 1947, p. 464.

SUMARIO

Coartación de la Aorta con Regresión de la Escotadura Costal Consecutivamente a la Cirugía. Presentación de un Caso

Un enfermo, niño de catorce años de edad, que padecía de coartación de la aorta reveló mejoría bien definida de la erosión costal al año de resecarse el segmento estrechado de la aorta y de ejecutarse una anastomosis término-terminal. Parece que esto es consecuencia del potencial disponible para osteoanagénesis a la edad del enfermo y demuestra un magnífico resultado operatorio, con retorno de la circulación sanguínea al cauce normal de modo que ya no hay que atenerse a los vasos colaterales para el riego sanguíneo en la porción distal de la aorta.

Distribution of Colloidal Radioactive Chromic Phosphate After Intracavitary Administration[1]

SAMUEL W. ROOT, M.D., MALCOLM P. TYOR, M.D., GOULD A. ANDREWS, M.D., RALPH M. KNISELEY, M.D.

COLLOIDAL radioactive gold, Au^{198}, has been used for several years in the palliative treatment of patients with recurrent pleural and abdominal effusions caused by malignant neoplasm. Its use has been reasonably well established and evaluated, but the results, although encouraging, leave much to be desired. The extent of the contribution of the gamma emission of the radioactive gold to the therapeutic result is not known, but this component of the radiation produces a total-body effect that is undesirable. An isotope which, like colloidal gold 198, remains largely in the region of the injected cavity, yet has only a beta emission, would have the advantage of producing less total-body irradiation. Since the need for protecting the operator against gamma radiation complicates the use of the gold, a beta emitter would also be easier to administer. P^{32} with an energetic beta emission of 1.72 mev, in the form of a colloid, chromic phosphate, should be useful for this purpose. The chromic phosphate can be made in a stable colloidal form so that there is little dissociation *in vitro*.

In evaluating the use of chromic phosphate for intracavitary injection, it is important that several questions be answered.

1. Is the material stable and not dissociated in the body following injection?
2. Is there a tendency for it to settle or plate out on pleural or peritoneal membranes, as does gold 198, or does it remain equally distributed throughout the fluid in the cavity?
3. Are there any significant hematological changes following its use in therapeutic amounts?
4. Finally, is there any advantage over colloidal gold 198 or deep x-ray therapy in the control of recurrent effusions in patients with cancer?

The present report is not an answer to all of these questions but is concerned only with efforts to gather data on the metabolism and distribution of chromic phosphate after intracavitary injection. No clinical effects are considered.

METHODS

Four patients with pleural effusion and 6 with ascites, all of whom had cancer (proved histologically) were selected. The effusions were recurrent and necessitated paracenteses for relief. The chromic phosphate used was obtained from Abbott Laboratories. It takes several days to produce each batch, and this probably contributes to the present rather high cost.

In order to obtain data on the concentration of the chromic phosphate in the fluid of the abdominal and pleural cavities at various intervals after injection, two Polyethylene tubes were placed in the cavity. Through one of these the colloid was injected; through the other samples were drawn at intervals for radioassay. The patients were instructed to turn and move around in order that the colloid might be uniformly distributed. Following intracavitary administration, the levels of radioactivity in the blood, pleural and peritoneal fluids, and urine were measured at intervals. Samples were obtained frequently at first and then at longer intervals, since it was believed, from earlier studies with gold, that the initial disappearance from the fluid would be rapid. Blood samples usually were withdrawn at the same time that the fluid specimens were obtained. In 3 patients, who died at varying intervals after administration of

[1] Work done at the Medical Division, Oak Ridge Institute of Nuclear Studies, Inc., Oak Ridge, Tenn., under contract with the United States Atomic Energy Commission. Presented at the Thirty-ninth Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 13–18, 1953.

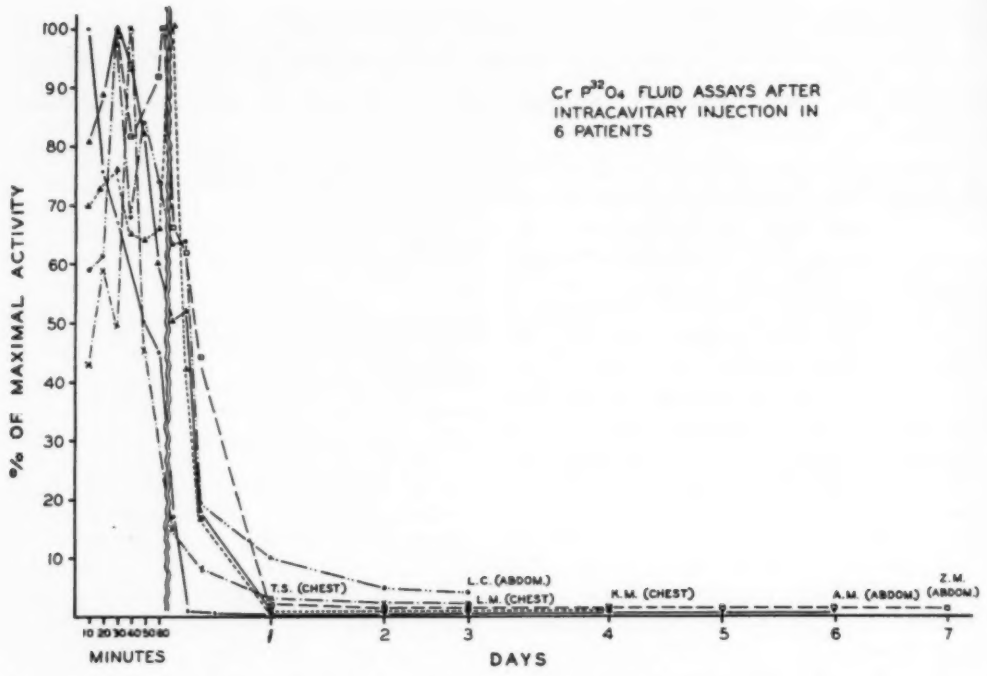

Fig. 1. Concentrations of radioactivity in the pleural and abdominal fluid of 6 patients after intracavitary administration of $CrP^{32}O_4$.

the colloid, autopsies were performed and tissue distribution data were obtained. Microscopic and gross autoradiograms were prepared from the tissues of these patients. The tissues were assayed for radioactivity by treating them with nitric acid and counting them in liquid form by means of a thin end-window Geiger tube.

RESULTS

Figure 1 shows the concentration of radioactivity plotted against time in the pleural and abdominal fluid of 6 patients. An erratic variation of concentration in the first hour probably represents mixing. Following this, there is a decrease in radioactivity that is too rapid to be a result of dilution. Since there is little absorption from the cavity, as will be shown later, this decrease must result from the settling out of the colloid on the serous membranes. This uniform pattern of decreasing concentration was not seen in 3 patients who showed fluctuating high levels for several days. The reason for these high variable levels is not clear. It seems likely that they are related to the tendency of the colloid to settle out with gravity. There may have been inadequate mixing in the cavity before samples were drawn, or failure to assay representative aliquots of fluid. Figure 2 shows the concentration of radioactivity plotted against time, in pleural fluid before centrifugation and in the supernatant layer after centrifugation. There is about ten times as much activity in the fluid before centrifugation as there is in the supernatant layer. Microscopic autoradiograms of the sediment show aggregates of radioactivity associated with cellular material but do not show whether it is adsorbed on the cells or actually incorporated within them as ionic P^{32}.

Figure 3 shows the averages of radioactivity levels determined on whole blood, washed red blood cells, and plasma in 3 patients. Most of the radioactivity is

TABLE I: TISSUE DISTRIBUTION OF $CrP^{32}O_4$ AT AUTOPSY. DAR* IN THREE PATIENTS WHO RECEIVED INTRACAVITARY $CrP^{32}O_4$

Patient and Days After Injection →	T. S. 14	J. H. 14	J. E. H. 3
Liver	0.51	0.39	5.74
Spleen	0.54	0.08	Surgically removed
Marrow	0.24	0.05	0.82
Lung	0.18	0.10	0.41
Adrenal	0.24	B.G.	0.86
Kidney	0.24	0.07	0.83
Lymph nodes distant from cavity	0.19	0.08	0.95
Lymph nodes adjacent to cavity	65.17	5.93	4.76
Serous membrane of cavity	451.7 (pl)	7.38 (pn)	41.47–1.37 (pn)

* DAR = $\frac{\mu c./gm. \text{ in organ corrected for decay}}{\text{dose, } \mu c./body \text{ wt., gm.}}$

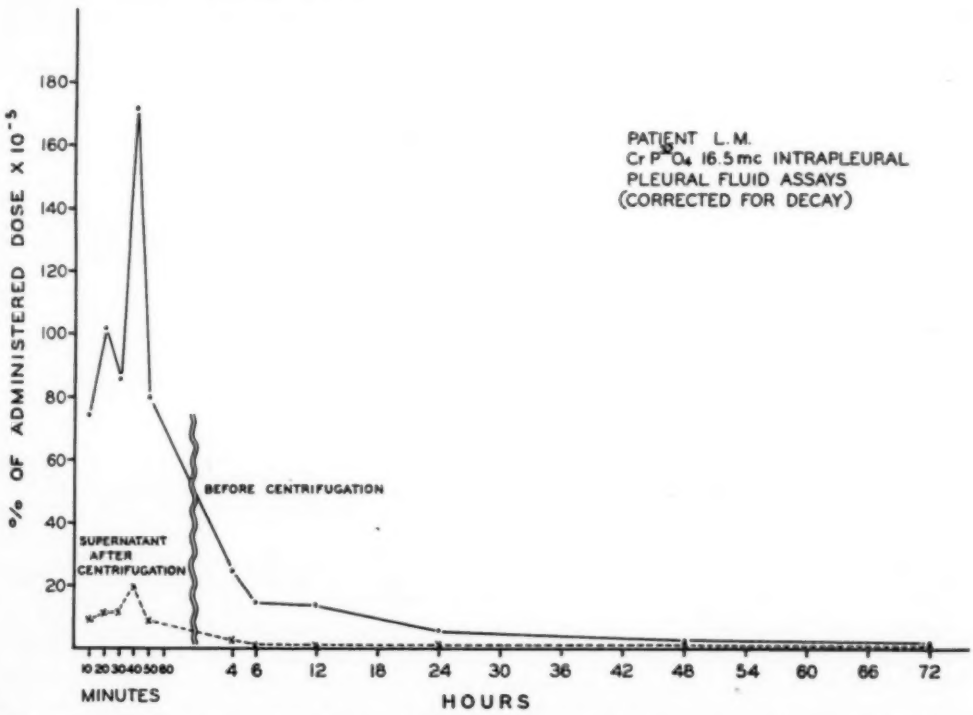

Fig. 2. Concentration of radioactivity in pleural fluid containing $CrP^{32}O_4$, before and after centrifugation. Most of the radioactivity is found in the sediment.

seen to concentrate in the red blood cell portion. Upon hemolysis and dialysis of these red blood cells, 41 per cent of their radioactivity passes into the dialysate, which indicates that they contain ionic phosphate. One must assume, then, that much of the radioactivity in the blood results from ionization of the chromic phosphate. This concentration of radioactivity is quite different from that seen after intracavitary injection of gold, which shows very little concentration in the red blood cells. It is important to realize that the total amount of P^{32} circulating in the blood at any time is actually quite small. In the 3 patients shown, the maximum amount, obtained by multiplying the concentration of P^{32} per milliliter of blood by the estimated blood volume, was slightly less than 1 per cent of the administered dose.

Urinary excretion of the chromic phos-

TABLE II: APPROXIMATE DISTRIBUTION OF $CrP^{32}O_4$ IN ORGANS AT AUTOPSY AFTER INTRACAVITARY INJECTION

Patient	Dose (mc.)	Cavity of Injection	Days After Last Dose	Per Cent in Liver	Per Cent in Spleen	Per Cent in Marrow
T. S.	19.5	Pleural	14	1.57	0.14	1.19
J. H.	2.2	Peritoneal	14	0.97	0.02	0.23
J. E. H.	4.8	Peritoneal	3	12.8	Surgically removed	4.09

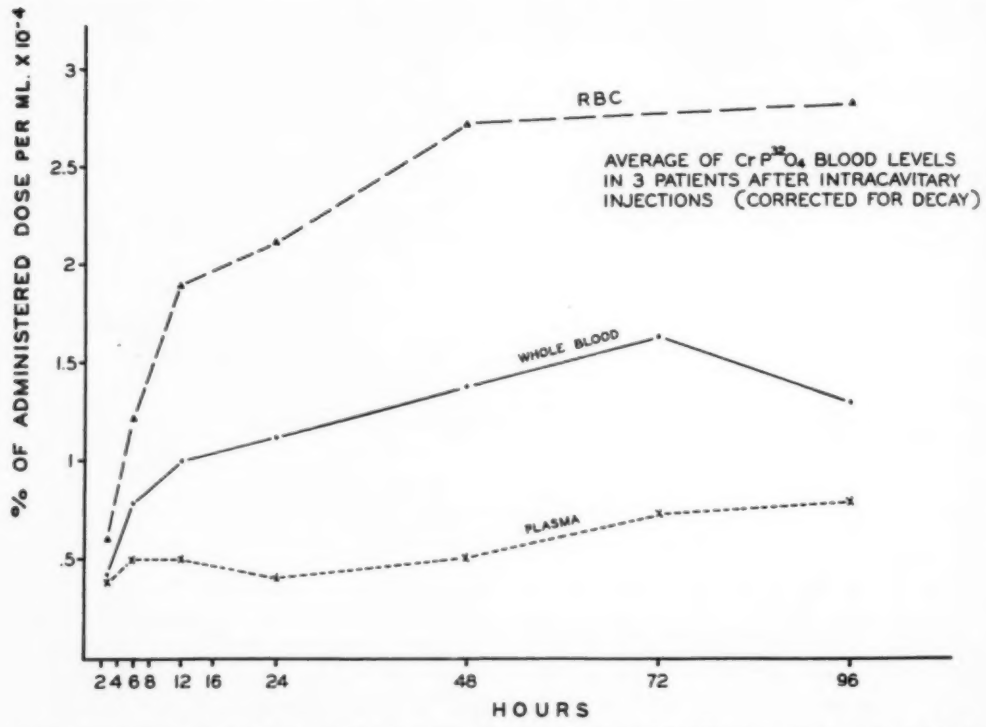

Fig. 3. Averages of levels of radioactivity after intracavitary injection of $CrP^{32}O_4$ determined on whole blood, washed red blood cells, and plasma.

phate in 10 patients is shown in Figure 4. The average is approximately 5 per cent of the administered dose over a period of eleven days. This is considerably more than the amount of gold 198 excreted over a similar period of time and suggests that much of the excretion is of ionic phosphate.

Autopsy distribution data for 3 patients are shown in Table I, where the relative concentrations in different organs are compared. Two items are of particular interest. The highest concentration of radioactivity is on the serous membranes of the injected cavities, and the uptake in lymph nodes adjacent to these cavities is relatively good. We have not seen gold 198, similarly administered, concentrate to such an extent in lymph nodes. Table II shows the percentage of the administered dose concentrated in the liver, spleen, and marrow in the same 3 patients. The percentage in the marrow can be only a rough approximation. The distribution in these reticulo-endothelial organs is very similar to that of gold 198. One would not, however, expect to find such a high concentration as 12 per cent in the liver (shown for patient J. E. H.) three days after an injection of gold.

If there is ionization of the chromic phosphate, one might expect to find a higher concentration in neoplastic tissue

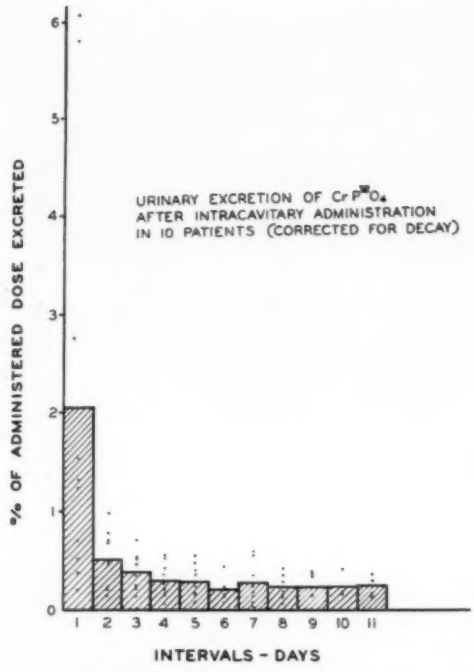

Fig. 4. Urinary excretion of $CrP^{32}O_4$ after intracavitary administration.

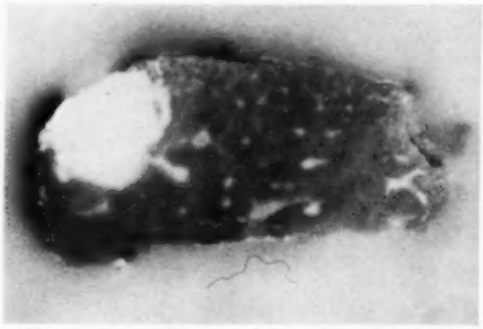

Fig. 5. Autoradiogram of liver (containing metastatic neoplasm) following intraperitoneal administration of colloidal radioactive gold, Au^{198}. There is no concentration in the neoplastic area.

than if it all remained as a true colloid. Figure 5 shows an autoradiogram prepared from the liver of a patient given gold 198 intraperitoneally. No radioactivity is seen in the areas of metastatic neoplasm, which involves the liver extensively, but there is a good concentration in the liver parenchyma. Figure 6 shows a photograph and autoradiogram of liver from a patient with lymphosarcoma given ionic P^{32} intravenously. Here, there is a higher concentra-

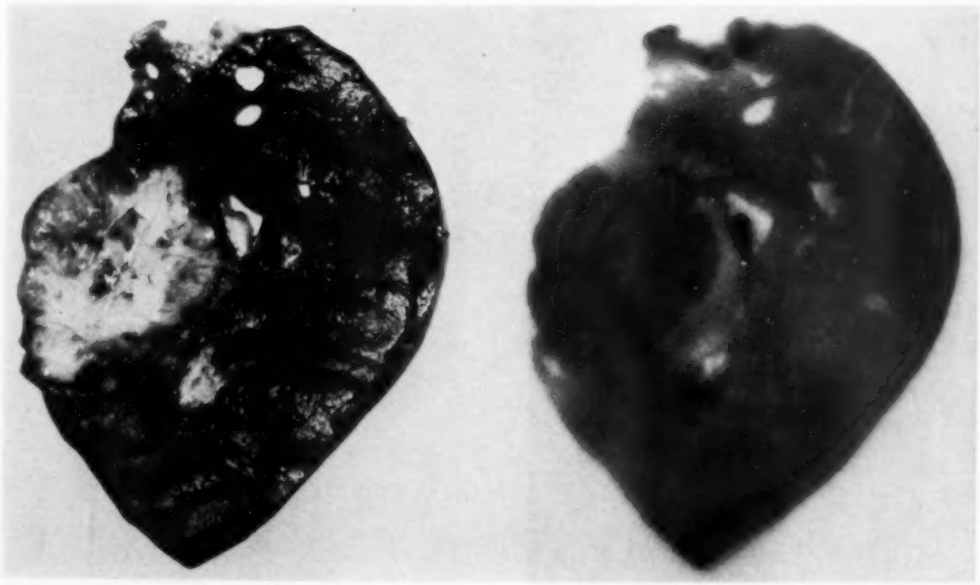

Fig. 6. Photograph (left) and autoradiogram of liver (containing metastatic neoplasm) following intravenous administration of P^{32} as sodium phosphate. There is a higher concentration of P^{32} in the neoplasm than there is in the liver parenchyma.

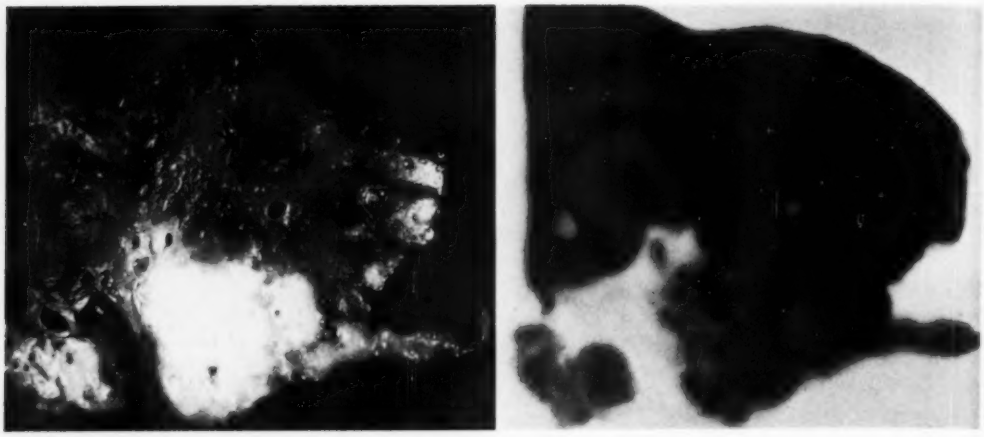

Fig. 7. Photograph (left) and autoradiogram of liver (containing metastatic neoplasm) following intraperitoneal administration of colloidal $CrP^{32}O_4$. There is concentration in both liver parenchyma and neoplasm, with the greater amount in the liver.

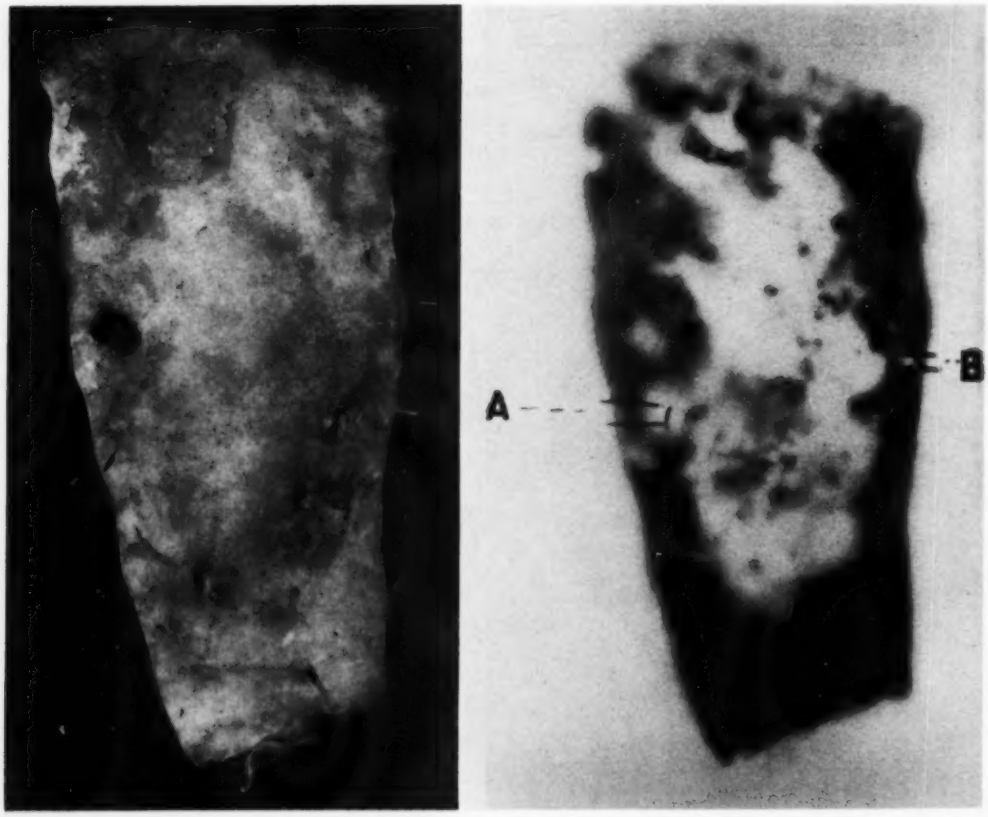

Fig. 8. Photograph (left) and autoradiogram of parietal pleura following intrapleural administration of colloidal $CrP^{32}O_4$. The central area that is invaded by neoplasm shows little concentration of the isotope.

tion in the tumor than in the liver. Figure 7 is a photograph and autoradiogram from the liver of a patient given chromic phosphate intraperitoneally. Deposition of radioactivity is seen in both tumor and liver, suggesting that the chromic phosphate is distributed like both phosphate ion and a colloid.

Figure 8 shows a photograph and an autoradiogram prepared from a flattened sheet of pleura invaded by neoplasm, from a patient given colloidal radioactive chromic phosphate intrapleurally. There is little activity in the tumor compared with a good deposition on the surrounding surface. This is only an isolated case, and we have no evidence that it represents a pattern of distribution.

DISCUSSION

The information presented here is based on only a small number of patients, but the results seem fairly consistent. There is good evidence that after the injection of chromic phosphate most of the radioactivity remains on the walls of the injected cavity. Only a small percentage of the injected dose is present in the blood at any one time, but it is a larger proportion of the dose than is seen after injection of gold 198. Three points of interest in which the behavior of the chromic phosphate differs from that of gold 198 after its intracavitary injection are the high concentration of radioactivity in the red blood cells, the higher urinary excretion, and the greater deposition in neoplastic tissues. These results suggest strongly that some of the radioactive phosphorus has broken away from the colloidal complex and is distributed like phosphate ion.

SUMMARY

Preliminary studies indicate that the distribution of chromic phosphate after intracavitary injection is similar in most respects to that of colloidal radioactive gold. There is evidence, however, for some ionization of the chromic phosphate and this ionized portion follows the distribution expected for phosphate ion. From the point of view of distribution, chromic phosphate appears to be suitable for intracavitary therapeutic use.

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SUMARIO

Distribución del Fosfato Crómico Radioactivo Coloidal después de la Administración Intracavitaria

Estudios preliminares indican que la distribución del fosfato crómico radioactivo coloidal a continuación de la administración intracavitaria es semejante en su mayor parte a la del oro radioactivo coloidal. Tres puntos de interés en que el comportamiento del fosfato crómico discrepa del oro son: (1) la alta concentración de radioactividad en los glóbulos rojos; (2) la mayor excreción urinaria; y (3) el mayor depósito en el tejido neoplásico. Esos resultados sugieren que parte del fósforo radioactivo se desintegra del complejo coloidal y se distribuye según sería de esperar para el yon fosfático. Desde el punto de vista de la distribución, el fosfato crómico radioactivo parece ser apropiado para empleo terapéutico.

La serie en que se basan estas conclusiones comprendió a 4 enfermos con derrame pleural y a 6 con ascitis, todos ellos con cáncer, comprobado histológicamente.

(For Discussion of this paper, see following pages.)

DISCUSSION

Raymond L. Libby, Ph.D. (Los Angeles, Calif.): It is indeed a pleasure to open the discussion on a paper such as that presented by Dr. Root and coauthors, which adds to our basic knowledge of the properties of various radioactive materials used in the treatment of cancer—in this instance, intracavitary radioactive chromic phosphate.

The authors have evaluated four factors in the use of $CrP^{32}O_4$:

First, they have shown that $CrP^{32}O_4$ does plate out on the walls of the cavity. This probably accounts for most of its effectiveness. Our own studies would confirm this observation.

Second, they have not observed any alarming hematological effects which would preclude the use of $CrP^{32}O_4$.

Third, they have pointed out certain obvious advantages of $CrP^{32}O_4$ over colloidal gold for intracavitary use. To these observations I might add that a P^{32} beta particle of average energy will affect a volume of tissue fifty times that of the average gold beta particle.

Fourth, and finally, they have studied the stability of $CrP^{32}O_4$ *in vivo* and have presented some evidence for its dissociation or ionization, *i.e.* (*a*) a greater concentration of P^{32} activity in red cells than in plasma; (*b*) the deposition of P^{32} activity in liver metastases; (*c*) the urinary excretion of P^{32} activity.

This extracavitary radioactivity is of course undesirable. I would like to comment briefly on this problem. Our own studies would indicate that most, if not all, of the P^{32} activity found in the blood and urine and other organs after an intracavitary injection of $CrP^{32}O_4$ may be accounted for by the presence of a readily dialyzable P^{32} fraction in the $CrP^{32}O_4$. We have observed such a fraction in our own $CrP^{32}O_4$ preparations as well as in Abbott preparations. This dialyzable fraction represents anywhere from 1 to 4 per cent of the total P^{32} activity and is enough to account for the extracavity P^{32} activity observed by the authors.

I would like to make just one final comment—about the criteria that should be used to select the patients for intracavitary $CrP^{32}O_4$. In our own experience, the most successful results have been obtained on those patients who have exhibited free tumor cells in the pleural or ascitic fluid; we have seen little or no response in those patients with no free tumor cells.

Bernard Roswit, M.D. (New York, N. Y.): At the Veterans Hospital in the Bronx, New York, we have been utilizing a colloidal suspension of chromic phosphate containing P^{32} for more than two years for the interstitial treatment of advanced inoperable tumors of the head and neck and certain other inoperable tumors. It is of interest that in these investigative studies, the metabolic distribution was almost identical with that described by the Oak Ridge group after intracavitary injection. We have carefully followed a patient with lymphosarcoma and pleural effusion, who benefited from intracavitary use of this radiomaterial. In a preliminary tracer study, we noted a prompt disappearance from the pleural fluid (a matter of minutes), suggesting deposition on the pleura itself. This is a very satisfactory event, for optimum pleural irradiation. From theoretical consideration alone, P^{32} would seem to be a better agent for this function than Au^{198}, by virtue of its longer half-life, more energetic beta particle, ease and safety of handling. We expect to proceed with this type of investigation. Incidentally, the interstitial use of colloidal chromic phosphate with P^{32} for advanced neoplasms of the head and neck appears promising.

Wm. G. Myers, M.D. (Columbus, Ohio): In view of the findings of the many workers on the toxicity of chromium, I am wondering whether the authors have had an opportunity to make any determinations of blood coagulation in these patients, because it is well known that chromium toxicity is very greatly prolonged, perhaps (thinking out loud) due to the effect on the liver.

I would like to ask also, in view of the toxicity of chromium, whether they have tried to use any of the phosphates of the physiological group. I am particularly thinking of calcium phosphate or iron phosphate. These are also soluble and probably could be used to get away from the toxicity of chromium. Chromium is known not only to be toxic in this respect but it seems likely, also, that it may have a carcinogenic effect.

Paul C. Aebersold, Ph.D. (Oak Ridge, Tenn.): In considering such matters we must definitely take into consideration the amount of material injected. When one considers that the amount of chromic phosphate used in these cases is on the order of a few milligrams, I don't think we need to be too concerned about toxicity or carcinogenic effect. Furthermore, these patients already have advanced cancer.

Perhaps some other phosphate could and should be used, such as iron phosphate, but considerable development would be necessary to test the preparation procedures, degree of solubility and distribution within the body.

Donalee L. Tabern, Ph.D. (Abbott Laboratories, North Chicago, Ill.): With respect to Dr. Myers' comments upon the possible physiological action of chromic phosphate, I think that we must very carefully keep in mind the amounts of material involved. When chromic phosphate of our preparation is administered, the actual amount of chromium is on the order of a fraction of a milligram or so, certainly far below any possible hazard level. As

for the potential action of chromium, I believe such studies are already under way at Ohio State and show no bad reactions in amounts anywhere near the order of those here involved.

I can further state that we have prepared other presumably colloidal insoluble phosphates and have studied them both chemically and in animals. None of them show anywhere near the valuable properties, as far as distribution and lack of absorption are concerned, as does properly prepared chromic phosphate of appropriate particle size and in a suitable menstruum. This work is being submitted for publication very shortly.

Dr. Root (*closing*): Although we have not made a special study of toxicity of chromium, we have not seen any gross evidence of it in the patients treated. Certainly the few patients who have come to autopsy have showed no histologic evidence of liver damage, which would be expected in chromium toxicity.

In the present study we were not particularly concerned about any carcinogenic effect of the chromium because all the patients had widespread metastases.

We have not tried any other phosphates that are more insoluble, but, as Dr. Myers suggested, they might have some advantage.

I do not know of any very scientific reason for the dosages employed for the clinical studies. The 20 millicurie dose seemed to result in about the maximal safe blood level, and we have not exceeded this amount; whether it is the optimum dose or not, I do not know.

EDITORIAL

Editorial Responsibility

It is well known that publication of erroneous statements about an individual, particularly if they are of a scandalous or spectacular nature, can work irreparable harm. Retractions or corrections may be published later, but they are generally in fine print and usually are overlooked by the reading public, so that the evil effect is never entirely erased. It is not as generally appreciated that the publication in a medical journal of an article containing misinterpretation or misstatement of fact, and the drawing therefrom of unsubstantiated and unjustified conclusions, can work a much greater degree of harm, for it may influence adversely the diagnosis and treatment of thousands of patients. This is more than ever the case today, when the better American medical journals are read throughout most of the free world and it is customary to abstract articles in dozens of other publications and to reproduce them in capsule form in one or more of the many pocket-sized digest journals which have become so popular with practicing physicians and specialists. Even if the misinformation should be corrected in the journal of origin, this correction is not likely to be repeated in the abstract journals.

There has recently come to the writer's attention a case report affording a striking illustration of just such an error and its perpetuation. In his opinion, not only was the pathological diagnosis wholly erroneous, but it was supported by a reference to the literature in which a similar error had been made.

Editors of the various reputable general and specialty medical journals make honest efforts to winnow the heterogeneous material submitted to them for publication and, in so far as their knowledge goes, they succeed very well. Realizing that medicine is a cooperative effort and that one specialty must make use of numerous ancillary ones concerning which the editor-in-chief is not an expert, it is a usual but by no means a universal practice to have an advisory editorial board of experts in these other fields. The publication in each issue of the journal of the names of these consultants, who are usually men and women of national reputation, strengthens the confidence of the reading public in the reliability of the papers published in that journal. This is excellent in theory, but often it has only the value of window dressing. In some instances the advice of the advisory board members may never be sought; in others only once in two or three years. I wonder if these gentlemen and ladies realize that by permitting the publication of their names as editorial consultants they give tacit approval to everything published in the journal.

It seems to the writer that editors-in-chief should make more use of their advisory board members; both the authors and the journal itself could profit by expert criticism, and certainly the reading public would benefit. Further, the editor-in-chief could insist that, when a diagnostic procedure or a form of treatment is dependent upon the opinion or the work of an individual who is not a co-author, the name and perhaps the title of that individual should be stated, so that the reading public can form their own idea about reliability. It is a common practice for authors in all fields to make some such statement as "the pathologist reported . . .". It would be astonishing if all pathologists had an equal skill and experience in interpretation, and of course it is not true. Yet the authors, the editor, and the un-

suspecting reading public accept the word of this anonymous individual as if it were infallible. In this and similar situations, the editor should request that the author name this remarkable person. If he is not well known and his diagnosis is new or unusual, the editor should call upon his consultants for aid. The writer does not object to publication of material which is believed by the author to be new or to be contrary to generally accepted opinion. The objection is to an editor permitting an author to conclude dogmatically that his conception is true because he says it is true. No purely scientific journal would tolerate such a thing, and there is no reason that a clinical or specialty medical journal should do so. ARTHUR PURDY STOUT, M.D.

A Statement of Editorial Policy

The Editor commends to the attention of all readers of RADIOLOGY, and more especially its contributors, the foregoing remarks of Dr. Arthur Purdy Stout, whom we are proud to count as a member of our Advisory Editorial Board. In this connection a statement of editorial policy may be fitting.

Articles which are submitted to RADIOLOGY are referred for review to one or more members of its Publication Committee, the Editorial Advisory Board, or, under some circumstances, to authorities in special fields, and the utmost consideration is given to the opinions of these consultants before acceptance or rejection of a paper for publication. Honest difference of opinion may nevertheless exist, and the editor endorses most feverently Dr. Stout's suggestion that when a diagnostic procedure, a form of treatment, or a pathologic diagnosis is dependent upon the work of an associate not concerned in the authorship of a paper, that person be named and the responsibility thus be fairly placed. This might well be made a rule for all medical publications. So far, at least, as RADIOLOGY is concerned, it may be considered in force.

ANNOUNCEMENTS AND BOOK REVIEWS

FIFTH INTER-AMERICAN CONGRESS OF RADIOLOGY

The Fifth Inter-American Congress of Radiology which will be held in Washington, D. C., April 24 to 29, 1955, offers an extraordinary opportunity for graduate education. Immediately before the meeting of the Congress, the American Radium Society will hold its annual meeting in the same hotel, the Shoreham, and immediately following the Congress a short refresher course in the radioactive isotopes will be offered by the National Cancer Institute.

Thus it will be possible to spend approximately ten days in a scientific atmosphere which should be rewarding to every participant. It is anticipated that many radiologists from Latin-America, Canada and the United States will wish to take advantage of this unusual combination of scientific events.

During the meeting of the Congress itself there will be featured refresher courses on various subjects offered in both Spanish and English. These courses will be given by outstanding specialists in various fields and will prove to be of great benefit.

About 1,200 rooms have been reserved in the Shoreham and Wardman Park Hotels and everyone who contemplates attending the Congress is urged to apply at once for membership, to secure hotel reservations. Address communications to Office of the Secretary-General, 3400 Spruce St., Philadelphia 4, Penna.

ARKANSAS RADIOLOGICAL SOCIETY

The Arkansas Radiological Society, meeting in regular session in Little Rock, June 25, chose the following officers for the ensuing year: Dr. George C. Burton, of El Dorado, President; Dr. Edwin F. Gray, of Little Rock, Vice-President; Dr. Joe A. Martin, 843 Donaghey Bldg., Little Rock, Secretary-Treasurer; Dr. Cyrus P. Klein, of Texarkana, Dr. Ernest A. Mendelsohn, of Fort Smith, and Dr. Charles W. Anderson, of Pine Bluff, members of the Executive Committee. Dr. Cyrus P. Klein was named Councilor to the American College of Radiology.

NEW ENGLAND ROENTGEN RAY SOCIETY

At the annual meeting of the New England Roentgen Ray Society, held May 15, Dr. Jack Spencer, of Portland, Me., was elected President; Dr. Felix G. Fleischner, Boston, Mass., Vice-President; Dr. Magnus I. Smedal, Boston, Mass., Treasurer; Dr. Stanley M. Wyman, Massachusetts General Hospital, Boston, Mass., Secretary. For 1954–55 the meeting place of the Society will be the Hotel Commander, Cambridge, Mass.; the time, the third Friday of each month at 4:30 P.M.

MEDICAL SOCIETY OF THE DISTRICT OF COLUMBIA SECTION ON RADIOLOGY

The recently elected officers of the Section on Radiology of the Medical Society of the District of Columbia are: President, Karl C. Corley, M.D.; Vice-President, Francis C. Allman, M.D.; Secretary-Treasurer, John A. Long, M.D., 1801 K St., N. W., Washington 6.

NEW YORK ROENTGEN SOCIETY

The following officers were recently elected to serve the New York Roentgen Society for the ensuing year: Harold W. Jacox, M.D., President; Jacob R. Freid, M.D., Vice-President; Maxwell H. Poppel, M.D., Treasurer; Sidney Rubenfeld, M.D., 477 First Ave., New York 16, Secretary.

NORTH FLORIDA RADIOLOGICAL SOCIETY

The recently organized North Florida Radiological Society has elected Dr. Thomas H. Lipscomb, of Jacksonville, President, and Dr. Ivan Isaacs, 1045 San Marco Blvd., Jacksonville 7, Secretary-Treasurer. The Society will meet quarterly, in March, June, September, and December.

PENNSYLVANIA RADIOLOGICAL SOCIETY

The newly elected officers of the Pennsylvania Radiological Society are: President, George W. Chamberlin, M.D., of Reading; President-Elect, William T. Rice, M.D., of Rochester; First Vice-President, Mark K. Gass, M.D., of Sunbury; Second Vice-President, Lea A. Cobbs, M.D., of Salem, Ohio; Editor, Carl B. Lechner, M.D., of Erie; Secretary-Treasurer, James M. Converse, M.D., 416 Pine Street, Williamsport.

The next annual meeting of the Society will be held May 20–21, 1955, at the Berkshire Hotel, Reading.

PITTSBURGH ROENTGEN SOCIETY

At the June meeting of the Pittsburgh Roentgen Society, the following were elected to office: Dr. Peter M. Feltwell, Jr., President; Dr. Karl J. Myers, Vice-President; Dr. Newton Hornick, Treasurer; Dr. Donald H. Rice, 4800 Friendship Ave., Pittsburgh 24, Secretary. Dr. Lester M. J. Freedman was elected to the Executive Committee, and Dr. S. G. Henderson, Councilor to the American College of Radiology.

The Society meets at the Hotel Roosevelt on the second Wednesday of the month, October through June.

BRITISH INSTITUTE OF RADIOLOGY ANNUAL CONGRESS AND EXHIBITION

The Council of the British Institute of Radiology announces that arrangements have been made for the Annual Congress for the Session 1954–55, to take place in the week commencing Nov. 22, 1954. The scientific meetings will be held on Nov. 24, 25, and 26, in the Lecture Room of the New Horticultural Hall, Vincent Square, London, S. W. 1, and in the Drill Hall of the Westminster Dragoons, Elverton Street, London S. W. 1. The scientific exhibition will be housed in the Old Horticultural Hall.

The program of the Congress is being planned on lines similar to those of previous years, with symposia on diagnostic and therapeutic subjects, radiophysics and radiobiology. The Mackenzie Davidson Memorial Lecture will be given on the evening of Nov. 25 and a dinner on the evening of Nov. 26.

For the first time since 1938 the British x-ray industry is to organize an exhibition of x-ray equipment and materials in conjunction with the Annual Congress. The Exhibition will be held in the Old Hall of the Royal Horticultural Society, which is conveniently close to the New Hall and to the Westminster Dragoons' Drill Hall. The Exhibition will open at 2 P.M. on Tuesday, Nov. 23, and on the following three days at 9 A.M. It will remain open each day until 6 P.M., except on Thursday, when the closing time is extended to 8 P.M. The Organizing Secretary is Mr. A. Beetlestone.

EASTMAN CENTENNIAL

The Centennial of the birth of George Eastman, father of modern photography, was observed on Monday, July 12, with appropriate ceremonies in Rochester, N. Y. A feature of the celebration was the dedication of the frame building in which the inventor was born, recently moved to Rochester from Waterville, N. Y., to become a part of the permanent exhibit on the history and development of photography maintained by the Eastman Kodak Company. The Centennial was the occasion of the issue of a new commemorative stamp honoring George Eastman, having its first-day sale in Rochester on July 12.

DR. L. HENRY GARLAND HONORED

Dr. L. Henry Garland, Secretary of the Cancer Commission of the California Medical Association, has recently been honored by the American Cancer Society's award for distinguished service in the field of cancer control.

RADIOLOGICAL HEALTH TRAINING PROGRAM

In recognition of the increased use of radiation and the associated health protection problems, the Public Health Service, U. S. Department of Health, Education, and Welfare, sponsors a radiological health training program. The purpose of the program is to indoctrinate public health workers with the significance of ionizing radiations, the environmental and occupational hazards attendant on their use, and recommended procedures for minimizing such hazards. The training program is presented at the Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. It is designed primarily for professional personnel of State and local health departments, but a limited number of qualified applicants from other governmental agencies and industry will be welcome.

The following courses will be presented in 1954–55:

November 1–5, Problems of Radioactivity in Waterworks
January 10–21, Basic Course in Radiological Health
January 24–February 4, Occupational Radiation Protection
March 7–10, Radiation Hygiene—Preventive Medical Aspects
April 18–29, Basic Course in Radiological Health
May 2–13, Environmental Radiation Sanitation Course
May 16–20, Problems of Radioactivity in Waterworks

For further information address: Chief, Radiological Health Training Section, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 26, Ohio.

UROLOGY AWARD

The American Urological Association offers an annual award of $1,000 (first prize of $500, second prize $300, and third prize $200) for essays on the result of some clinical or laboratory research in Urology. Competition is limited to urologists who have been graduated not more than ten years, and to men in training to become urologists.

The first prize essay will appear on the program of the forthcoming meeting of the American Urological Association, to be held at the Biltmore Hotel, Los Angeles, Calif., May 16–19, 1955.

Full particulars may be obtained from the Executive Secretary, William P. Didusch, 1120 North Charles St., Baltimore, Md. Essays must be in his hands before Jan. 1, 1955.

Letter to the Editor

To the Editor of Radiology

DEAR SIR:

I have read in the May issue (1954) of RADIOLOGY an article entitled: "Roentgenographic Demonstration of Histologically Identifiable Renal Calcification," by JD Mortensen, A. H. Baggenstoss, M. N. Power, and D. G. Pugh, in which the authors state that "parenchymal calcification commonly exists in kidneys to a degree, extent, or type that is not discernible roentgenographically." Such a generalization is incorrect in this case and it may be misleading for many young radiologists who are

accustomed to see in your journal only scientifically proved conclusions.

X-rays furnish not only morphological evidence of the presence of some absorber in the tissue but also an absorptive evidence. If such minute structures as the walls of capillaries or intercellular spaces were impregnated with calcium, *macro*roentgenography would not bring these structures to view. The calcium in this case would cause only an increase of the coefficient of x-ray absorption in this tissue. That is to say, the tissue impregnated with calcium will appear whiter in the radiograph than non-impregnated tissue. Obviously, one has to have for comparison radiographs of the two tissues made with the same technic. The radiographs presented by the authors prove only that no *macro*structure is impregnated with the calcium in their gross specimen.

A second mistake made by the authors is their attempt to compare two incompatible things: the histologic picture of the kidneys with the results of *macro*roentgenography of these organs. The authors should know that x-rays appear to be the most precise method for the detection of minute quantities of calcium in tissue. But for this, one must use the historoentgenographic (*micro*radiographic) technic described by Lamarque, Engstroem, and others.

Finally, the kidneys in the body are surrounded by many tissues which change the coefficient of x-ray absorption. In other words, if one would succeed in finding morphological evidence of the presence of calcium in a gross specimen, it would not mean necessarily that this calcium would be seen in a *macro*radiograph of the specimen surrounded by tissues; this would be the case only if the coefficient of x-ray absorption of a given quantity of calcium in the specimen were higher than that of all adjacent tissues.

Yours respectfully,

FEDOR BOHATIRCHUK, M.D.
Research Associate in X-ray
University of Ottawa

The Editor is glad to publish Dr. Bohatirchuk's comment on the work of Dr. Mortensen and his associates. He cannot agree, however, to the objection that a mistake has been made in attempting to compare histologically identifiable calcium with the roentgen picture. Indeed, the main point of the paper was to correlate the roentgen and histologic findings.

As to roentgenographic demonstration, this term would certainly be interpreted by most radiologists to indicate what Dr. Bohatirchuk designates as "macroroentgenography" rather than the highly specialized microradiographic technic. H. P. D.

Books Received

Books received are acknowledged under this heading, and such notice may be regarded as recognition of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

CONGENITAL HEART DISEASE. AN ILLUSTRATED APPROACH. By HENRY S. KAPLAN, M.D., Professor of Radiology, Stanford University School of Medicine, and SAUL J. ROBINSON, M.D., Assistant Clinical Professor of Pediatrics, Stanford University School of Medicine, Chief Department of Pediatrics, Mount Zion Hospital, San Francisco. A volume of 126 pages, with 146 illustrations. Published by McGraw-Hill Book Company, Inc., New York, 1954. Price $12.50.

SYMPOSIUM ON EFFECTS OF RADIATION AND OTHER DELETERIOUS AGENTS ON EMBRYONIC DEVELOPMENT. Sponsored by the Biology Division, Oak Ridge National Laboratory, Oak Ridge, Tenn. Reprinted from the Journal of Cellular and Comparative Physiology. A monograph of 337 pages, with numerous illustrations, including graphs, plates, and tables. Published by the Wistar Institute of Anatomy and Biology, Philadelphia, 1954.

GRENZ RAY THERAPY. PRINCIPLES, METHODS, CLINICAL APPLICATIONS. By GUSTAV BUCKY, M.D., Clinical Professor of Dermatology Emeritus, New York University, and FRANK C. COMBES, M.D., Professor of Dermatology and Syphilology, New York University Postgraduate Medical School, and Director of Dermatology and Syphilology, Bellevue Hospital. A book of 204 pages, with 62 illustrations. Published by Springer Publishing Company, Inc., New York, N. Y., 1954. Price $8.50.

A PLAN FOR RADIOGRAPHY IN OBSTETRICS. By Dr. J. BLAIR HARTLEY, F.F.R., Consultant Radiologist, St. Mary's Hospitals for Women and Children, Manchester, England, and Miss A. STIRLING FISHER, M.S.R., Superintendent Radiographer, St. Mary's Hospitals for Women and Children, Manchester, England. A monograph of 46 pages, with 14 illustrations. Published by St. Mary's Hospitals Management Committee, and obtainable at 5*s*-6*d* (11-0*d* airmail) from the Superintendent, St. Mary's Hospitals, Whitworth Park, Manchester 13, England.

Book Reviews

THE FUNDAMENTALS OF X-RAY AND RADIUM PHYSICS. By JOSEPH SELMAN, M.D., Director, School for X-Ray Technicians, Tyler Junior College; Chief of Radiology, Mother Frances Hospital; Director, Radiology Department, Medical Center Hospital; Consultant in Radiology, East Texas Tuberculosis Hospital, Tyler, Texas. A volume of 340 pages, with 174 illustrations and 8 tables. Published by Charles C Thomas, Springfield, Ill., 1954. Price $8.50.

Few student x-ray technicians have an adequate background of physics and mathematics. To make

good this lack, the author has prepared a text on the basis of lectures which he has delivered over a period of years to technicians in training, setting forth the fundamental principles of radiation physics and chemistry as they enter into the work of the technician.

The book begins with a brief review of mathematics, from simple fractions through geometry, followed by chapters on some of the basic concepts of physics—units of measurement, energy, the structure of matter, electricity, magnetism, etc. The x-ray circuit, darkroom technic, the chemistry of radiography and film processing, and the various factors which influence the quality of radiographs are covered in detail, while shorter discussions of radium and the radioactive isotopes, and a chapter on protection round out the work.

The language throughout is simple and clear, and numerous line drawings supplement the text. Questions are given at the end of each chapter to test the student's comprehension, and there is a short bibliography at the end of the book for those who wish further reading material. The book is well adapted to the purpose for which it was written, and should prove a real help to the radiologist or physicist engaged in teaching technicians.

ROENTGENOGRAPHIC TECHNIQUE. A MANUAL FOR PHYSICIANS, STUDENTS, AND TECHNICIANS. By DARMON ARTELLE RHINEHART, A.M., M.D., F.A.C.R., Emeritus Professor of Anatomy and Roentgenology, University of Arkansas; Honorary Member, American Society of X-Ray Technicians; Honorary Registered X-Ray Technician; Roentgenologist to St. Vincent's Infirmary and the Missouri Pacific Hospitals, Little Rock, Ark. A volume of 454 pages, with 216 illustrations. Published by Lea & Febiger, Philadelphia, 4th ed., 1954. Price $8.50.

This is the fourth edition of a valuable and well established manual on the technical aspects of radiology. It follows the general plan of presentation used in previous editions, but has been revised and brought up to date to include recent advances in procedure.

The first portion of the text is devoted to the construction and maintenance of roentgen-ray machines, the nature of roentgen rays, and darkroom procedures. A basic roentgenographic technic is outlined, and experiments with the use of paraffin and presdwood blocks are described. The latter portion of the text is given over to the actual technic used in the roentgenographic study of various parts of the body. The work is amply illustrated by photographs of the procedures and by roentgenograms depicting the final results.

ROENTGEN DIAGNOSIS OF THE HEART AND GREAT VESSELS. By ERICH ZDANSKY, M.D, Professor of Roentgenology, University of Vienna, and Director of the Central Roentgen Institute of the Allgemeinen Krankenhaus. Translated by LINN J. BOYD, M.D., F.A.C.P., Professor and Director of Medicine, the New York Medical College, Flower and Fifth Avenue Hospitals. A volume of 500 pages, with 334 figures. Published by Grune & Stratton, New York, N. Y. First American Edition, 1953. Price $15.50.

The second German edition of Zdansky's work on the roentgenography of the heart and great vessels appeared in 1949. The First American Edition, as the present work has been designated, is based essentially on that text, with certain additions and revisions, notably as related to congenital anomalies.

The first third of the volume is concerned with the normal heart, which is well covered from nearly every point of view. The text is better adapted, however, for reference than as a text book, since much of the detail in fields such as cardiac measurement will be little used at the present time. Angiocardiography receives slight emphasis in this section or in the subsequent chapters.

The chapters on the abnormal heart are again presented in the style of a reference work rather than of a textbook. They are in general well done. The coverage of congenital heart disease, however, in spite of any additions which have been made, remains quite inadequate, and use of an unproved case for illustration is certainly open to question.

In summary, the book is a good reference work, particularly for the advanced fluoroscopist, but it suffers from the limited consideration of angiocardiography and congenital anomalies.

The physical make-up of the work is attractive. The illustrations are all positives, but this detracts little from their usefulness.

GRENZEN DES NORMALEN UND ANFÄNGE DES PATHOLOGISCHEN IM RÖNTGENBILDE DES SKELETTES (Dr. A. KÖHLER). Ninth edition, fully revised by Dozent Dr. E. A. ZIMMER, Bern/Fribourg. A volume of 672 pages with 1,282 illustrations. Published by George Thieme, Stuttgart, 1953. Distributors for U.S.A., Intercontinental Medical Book Corporation, N. Y. Price DM 88.—

As the title implies, this work is concerned with the borderlands between the normal and early abnormal in the roentgenology of the skeleton, though it abounds with excursions into the frankly pathologic.

The work begins with some general remarks on bone, cartilage, and soft parts. Discussion of the individual bones follows, beginning with the upper extremity, then the skull, spine and pelvis, and finally the lower extremity. The discussions are brief and to the point, and the fact that the illustrations are usually on the same page makes for easy reading. The latter (positives), with few exceptions, are excellent.

This work attempts, and in most cases succeeds, in answering the question of what is normal and what is not on the roentgenograms of the skeleton. As the reviewer scanned the illustrations, they recalled many of the problems that had arisen in his own personal experience, and whose solutions had been met the hard way. Perhaps too much emphasis has been put on the accessory bones of the tarsus and carpus, but this is a minor point.

This work under the editorship of Dr. Zimmer is bound to take its place, as have its predecessors under Dr. Köhler, among the true classics of radiology. It can be recommended to the beginner as well as to the experienced radiologist. It is hoped that similar works may be produced for the other systems of the body.

NEURORADIOLOGY. By MARIO LENZI. A volume of 320 pages, with 400 illustrations. Cromotipia Ettore Sormani, Milan, Italy.

In this volume Professor Lenzi has collected the best information available today on neuroradiological diagnosis, condensing it into 320 pages and illustrating it with excellent roentgenograms and schematic drawings.

The first chapter deals with the technic of the various examinations, including plain radiography, laminagraphy, encephalography, ventriculography and angiography (both arterial and venous). The indications and contraindications for these procedures are given in a clear and sensible manner. The second chapter discusses anomalies of the skull, traumatic and inflammatory processes, intracranial calcifications, localized destruction of bone, changes in the sutures and in the sella. The third chapter describes the various signs of intracranial tumors, and the fourth chapter considers conditions which simulate the presence of intracranial neoplasms. The fifth chapter is devoted to the diagnosis of the nature and the localization of intracranial lesions. The remainder of the book is given over to the spinal column and the spinal cord and contain chapters on technic, anatomy, myelography in its opaque and non-opaque forms, and indications and contraindications for its performance. The author then describes anomalies, calcifications, bone production and destruction, curvatures of the spine and disk lesions. The chapter on intramedullary and extramedullary tumors is particularly good and is clarified by excellent drawings.

This book is clearly written, well illustrated, and represents a real addition to the growing literature on neuroradiology.

In Memoriam

HAROLD E. NICHOLS, M.D.

The death of Dr. Harold E. Nichols of Seattle, Wash., on May 10, 1954, removes a long-time member from the Radiological Society of North America.

Harold Eugene Nichols was born in Steilacoom, Wash., on July 13, 1895. After preliminary education in Tacoma and pre-medical work at the University of Washington, he was graduated in medicine from the University of Oregon in 1926.

Dr. Nichols' interest in radiology had been aroused during World-War I, when he served in the Army as an x-ray technician, before attending medical school. After his graduation and a period of general practice in Olympia, Wash., this early interest revived, and he served a preceptorship under Dr. Frank E. Butler of Portland, Ore. In 1930 he started the practice of radiology in Seattle, and this he continued until his untimely death.

Dr. Nichols had been a member of the Radiological Society of North America since 1934, and for many years served as Counselor for the State of Washington. He was a Fellow of the American College of Radiology, a member of the American Trudeau Society, the Pacific Northwest Radiological Society, the Washington State Radiological Society, the American Medical Association, and the King County Medical Society.

The list of offices which he has held is a tribute to the respect with which he was regarded by his colleagues. He was at various times President of the Washington State Medical Association, the King County Medical Society, the King County Medical Service Corporation (two terms), the Washington State Radiological Association, the Pacific Northwest Radiological Society, and the Washington Tuberculosis Association. He was a member of the Nu Sigma Nu fraternity and Veterans of Foreign Wars, and was a Thirty-second degree Mason.

A leader in the medical profession and in his specialty of radiology in the Pacific Northwest, Dr. Nichols contributed generously of his time and manifest abilities to the improvement of medicine. He will be remembered not only for his leadership, but for his sincere and affable friendliness, which made and kept for him a host of friends.

He is survived by his wife, Mrs. Beulah Nichols, and a son, Eugene Nichols.

SYDNEY J. HAWLEY, M.D.

ISAAC F. GONZÁLEZ MARTÍNEZ, M.D., F.A.C.R.

Dr. Isaac F. González Martínez, the venerable figure of Puerto Rican medicine and one of Puerto Rico's outstanding citizens, died in the early hours of April 20, 1954, of coronary occlusion, while reading a book on nuclear physics. The son of modest Spanish settlers, Doctor González was born on a coffee plantation near Caguanas (Utuado), in Puerto Rico, on July 8, 1871. He grew up in the coastal town of Mayagüez and went to school in Maricao, where he graduated as *Bachiller* in 1890. He studied at the University of Barcelona (Spain) and received his *Licenciate* in Medicine, in 1897; later, in 1900, he

obtained his *Doctorate* from the University of Madrid.

Young Dr. González had just returned from Barcelona and begun a general practice of medicine and surgery in Mayagüez when he witnessed the change in political status of his beloved country from a young autonomous Spanish province to a U. S. territory. The dramatic circumstances of this change of sovereignty were followed, in the summer of 1899, by the San Ciriaco hurricane, which caused indescribable devastation in the island. As the tropical wind abated, Puerto Ricans and Americans found themselves identified in their efforts to help the suffering. It was there that Lieut. Bailey K. Ashford, M.C., U.S.A., discovered the hookworm and its relationship to the "tropical anemia" which for centuries had lowered the life expectancy of natives and settlers; Dr. González collaborated with Ashford in the establishment of sanitary measures to eliminate the infestation. As health officer of Mayagüez, he maintained his interest in parasitology and wrote numerous papers on the subject. He discovered the first cases of hepatic distomiasis and of intestinal schistosomiasis observed in the island. He was an active member of the Institute of Tropical Medicine, which became the first School of Tropical Medicine. He was also a member of the American Association of Parasitologists and of the American Public Health Association.

Isaac F. González Martínez, M.D.

(Drawing by Imelda Schubart Gentile, from a photograph)

In 1911, Dr. González became interested in radiology and attended specialty courses at New York Post-Graduate Medical School. He was among the first trainees of Regaud at the Curie Institute, and in 1920 he received his Diploma of Radiotherapy from the University of Paris. He also worked in Holtzknecht's service in Vienna and attended courses given by Wintz and Holfelder in Germany. From 1929 to 1948 he directed the Department of Radiology of the Hospital Díaz García of San Juan and was also consultant radiologist to the School of Tropical Medicine. In 1938, he was made a Diplomate of the American Board of Radiology and later a Fellow of the American College of Radiology; he was a member of the American Roentgen Ray Society and of the Radiological Society of North America. He was the founder and first president—and later Honorary President—of the Asociación Puertorriqueña de Radiología. He was also past-president of the Asociación Médica and of the Academia de Medicina of Puerto Rico and his country's Counselor in the Inter-American College of Radiology.

In 1938, Dr. González organized the Liga Puertorriqueña Contra el Cancer and gave it thereafter his indefatigable efforts without recompense. The League undertook the tasks of public education and the operation of the Hospital de Oncología for the treatment of indigents. In April 1953, the Most Reverend Bishop of San Juan represented Dr. González at the laying of the cornerstone of a new Cancer Hospital; in June, he would have received an honorary degree with the first graduating class, two generations his junior, of the Medical School of Puerto Rico. Though Dr. González failed to have the full measure of these well deserved honors, he had met his happiness in their pursuit.

Dr. González was a member of the Ateneo of San Juan and of Rotary and Lions International, and for many years was president of the Casino of Puerto Rico. A civic leader with political convictions, he fought in his youth for autonomy from Spain and later for U. S. citizenship for the islanders; he favored statehood for Puerto Rico but was pleased when it became a commonwealth. He had a patriot's love for Borinquen, but he understood that ideologies survive only when they are rooted in the character of the individual citizen.

In 1903, Dr. González was married to Maria Luisa Blanes, who survives him; their three children, Alicia, Hector and Georgina, and their four grandchildren, all came to the mainland for their college education.

Most of us will remember Dr. González as the white-haired soft-spoken, kindly gentleman, impeccable in attire, respectful of formality, alert listener, forceful debater, and witty conversationalist. He breathed the dignity of his profession and the pride of his ancestry; only the sadness of his eyes betrayed his loneliness and the knowledge that life had brought him sorrows as well as joys. A man of indomitable character, he reckoned that it is easier to win praise than to elude censure, and that successes are not as sweet as failures are bitter. In his

unbounded generosity and love for the sick he found his own redemption and the understanding that it is in giving that we receive.

J. A. DEL REGATO, M.D.

THOMAS WILLIAM MARTIN, M.D.

Dr. Thomas William Martin died on Jan. 15 at his home in Port Arthur, Texas, where he had practised radiology for many years. Dr. Martin was born in Auckland, New Zealand, in 1888, and was brought as a child to America. His early years were spent in Lake Charles, La. He attended Louisiana State University, was graduated in medicine from Tulane University in 1916, and served his internship in Charity Hospital, New Orleans. Following service in World War I, he was for eight years a ship surgeon for Holland-American Lines. After a residency in Tuoro Infirmary, Lake Charles, he moved to Port Arthur in 1930.

Dr. Martin was a member of the Radiological Society of North America, of the American College of Radiology, the Texas Radiological Society, and the Texas and Southern Medical Associations.

RADIOLOGICAL SOCIETIES: SECRETARIES AND MEETING DATES

Editor's Note: Secretaries of state and local radiological societies are requested to co-operate in keeping this section up-to-date by notifying the editor promptly of changes in officers and meeting dates.

RADIOLOGICAL SOCIETY OF NORTH AMERICA. *Secretary-Treasurer*, Donald S. Childs, M.D., 713 E. Genesee St., Syracuse 2, N. Y.

AMERICAN RADIUM SOCIETY. *Secretary*, Robert E. Fricke, M.D., Mayo Clinic, Rochester, Minn.

AMERICAN ROENTGEN RAY SOCIETY. *Secretary*, Barton R. Young, M.D., Germantown Hospital, Philadelphia 44, Penna.

AMERICAN COLLEGE OF RADIOLOGY. *Exec. Secretary*, William C. Stronach, 20 N. Wacker Dr., Chicago 6.

SECTION ON RADIOLOGY, A. M. A. *Secretary*, Paul C. Hodges, M.D., 950 East 59th St., Chicago 37.

Alabama

ALABAMA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. A. Meadows, Jr., M.D., Medical Arts Bldg., Birmingham 5.

Arizona

ARIZONA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. Lee Foster, M.D., 507 Professional Bldg., Phoenix. Annual meeting with State Medical Association; interim meeting in December.

Arkansas

ARKANSAS RADIOLOGICAL SOCIETY. *Secretary*, Joe A. Norton, M.D., 843 Donaghey Bldg., Little Rock. Meets every three months and at meeting of State Medical Society.

California

CALIFORNIA MEDICAL ASSOCIATION, SECTION ON RADIOLOGY. *Secretary*, H. R. Morris, M.D., 1027 D St., San Bernardino.

EAST BAY ROENTGEN SOCIETY. *Secretary*, Dan Tucker, M.D., 434 30th St., Oakland 9. Meets monthly, first Thursday, at Peralta Hospital.

LOS ANGELES RADIOLOGICAL SOCIETY. *Secretary*, Oscar Harvey, M.D., 3741 Stocker St., Los Angeles 8. Meets monthly, second Wednesday, Los Angeles County Medical Association Bldg.

NORTHERN CALIFORNIA RADIOLOGICAL CLUB. *Secretary*, H. B. Stewart, Jr., M.D., 2920 Capitol Ave., Sacramento. Meets last Monday of each month, September to May.

PACIFIC ROENTGEN SOCIETY. *Secretary*, L. Henry Garland, M.D., 450 Sutter St., San Francisco 8. Meets annually at time of California State Medical Association convention.

RADIOLOGICAL SOCIETY OF SOUTHERN CALIFORNIA. *Secretary-Treasurer*, George Jacobson, M.D., Box 146, 1200 N. State St., Los Angeles 33.

SAN DIEGO RADIOLOGICAL SOCIETY. *Secretary*, C. W. Bruner, M.D., 2456 Fourth Ave., San Diego 1. Meets first Wednesday of each month.

SAN FRANCISCO RADIOLOGICAL SOCIETY. *Secretary*, I. J. Miller, M.D., 2680 Ocean Ave., San Francisco 27. Meets quarterly, at the University Club.

SOUTH BAY RADIOLOGICAL SOCIETY. *Secretary*, James J. McCort, M.D., Santa Clara County Hospital, San Jose-Los Gatos Road, San Jose. Meets monthly, second Wednesday.

X-RAY STUDY CLUB OF SAN FRANCISCO. *Secretary*, Wm. W. Saunders, M.D., VA Hospital, San Francisco 21. Meets third Thursday at 7:45, Lane Hall, Stanford University Hospital.

Colorado

COLORADO RADIOLOGICAL SOCIETY. *Secretary*, Parker Allen, M.D., Children's Hospital, Denver. Meets monthly, third Friday, at University of Colorado Medical Center or Denver Athletic Club.

Connecticut

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary-Treasurer*, William A. Goodrich, M.D., 85 Jefferson St., Hartford 14. Meets bimonthly, second Wednesday.

District of Columbia

RADIOLOGICAL SECTION, DISTRICT OF COLUMBIA MEDICAL SOCIETY. *Secretary*, John A. Long, M.D., 1801 K St., N.W., Washington 6. Meets third Wednesday, January, March, May, and October, at 8:00 P.M., in Medical Society Library.

Florida

FLORIDA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, James T. Shelden, M.D., Box 1021, Lakeland. Meets in April and in October.

GREATER MIAMI RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Richard D. Shapiro, M.D., 541 Lincoln Road, Miami Beach. Meets monthly, third Wednesday, 8:00 P.M.

NORTH FLORIDA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Ivan Isaacs, M.D., 1645 San Marco Blvd., Jacksonville 7. Meets quarterly, March, June, September, and December.

Georgia

ATLANTA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Albert A. Rayle, Jr., M.D., 490 Peachtree St. Meets second Friday, September to May.

GEORGIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Herbert M. Olnick, M.D., 417 Persons Bldg., Macon, Ga. Meets in November and at the annual meeting of the State Medical Association.

RICHMOND COUNTY RADIOLOGICAL SOCIETY. *Secretary*, Wm. F. Hamilton, Jr., M.D., University Hospital, Augusta. Meets first Thursday of each month.

Hawaii

RADIOLOGICAL SOCIETY OF HAWAII. *Secretary*, Philip S. Arthur, M.D., Suite 42, Young Hotel Bldg., Honolulu. Meets third Friday of each month.

Illinois

CHICAGO ROENTGEN SOCIETY. *Secretary*, Elbert K. Lewis, M.D., 6337 S. Harvard Ave., Chicago 21. Meets at the University Club, second Thursday of October, November, January, February, March, and April at 8:00 P.M.

ILLINOIS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Stephen L. Casper, M.D., Physicians and Surgeons Clinic, Quincy.

ILLINOIS STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, George E. Irwin, Jr., M.D., 427 N. Main St., Bloomington.

Indiana

INDIANA ROENTGEN SOCIETY. *Secretary-Treasurer*, John A. Robb, M.D., 238 Hume-Mansur Bldg., Indianapolis 4. Meets twice a year, first Sunday in May and during fall meeting of State Medical Association.

TRI-STATE RADIOLOGICAL SOCIETY (Southern Indiana, Northwestern Kentucky, Southeastern Illinois). Secretary-Treasurer, Stephen N. Tager, M.D., 219 Walnut St., Evansville 9, Ind. Meets last Wednesday, October, January, March, and May, 8:00 P.M., at the Elks' Club, Evansville, Ind.

Iowa

IOWA RADIOLOGICAL SOCIETY. *Secretary*, James T. McMillan, M.D., 1104 Bankers Trust Bldg., Des Moines. Meets during annual session of State Medical Society, and in the Fall.

Kansas

KANSAS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, A. M. Cherner, M.D., Hays, Kansas. Meets in the Spring with the State Medical Society and in the Winter on call.

Kentucky

KENTUCKY RADIOLOGICAL SOCIETY. *Secretary*, David Shapiro, M.D., Veterans Administration Hospital, Louisville 6. Meets monthly, second Friday, at Seelbach Hotel, Louisville.

Louisiana

ORLEANS PARISH RADIOLOGICAL SOCIETY. *Secretary*, Joseph V. Schlosser, M.D., Charity Hospital of Louisiana, New Orleans 13. Meets second Tuesday of each month.

RADIOLOGICAL SOCIETY OF LOUISIANA. *Secretary-Treasurer*, J. T. Brierre, M.D., 700 Audubon Bldg., New Orleans.

SHREVEPORT RADIOLOGICAL CLUB. *Secretary*, W. R. Harwell, M.D., 608 Travis St. Meets monthly September to May, third Wednesday.

Maine

MAINE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Jack Spencer, M.D., Maine General Hospital, Portland 4. Meets three times a year—Spring, Summer, and Fall.

Maryland

BALTIMORE CITY MEDICAL SOCIETY, RADIOLOGICAL SECTION. *Secretary-Treasurer*, Paul W. Roman, M.D., 1810 Eutaw Place, Baltimore 17. Meets third Tuesday, September to May.

MARYLAND RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Paul W. Roman, M.D., 1810 Eutaw Place, Baltimore 17.

Michigan

DETROIT X-RAY AND RADIUM SOCIETY. *Secretary*, E. F. Lang, M.D., Harper Hospital, Detroit 1. Meets first Thursday, October to May, at Wayne County Medical Society club rooms.

Minnesota

MINNESOTA RADIOLOGICAL SOCIETY. *Secretary*, John R. Hodgson, M.D., The Mayo Clinic, Rochester. Meets in Spring and Fall.

Mississippi

MISSISSIPPI RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John W. Evans, M.D., 117 N. President St., Jackson, Miss. Meets monthly, on third Tuesday, at 6:30 P.M., at the Rotisserie Restaurant, Jackson.

Missouri

RADIOLOGICAL SOCIETY OF GREATER KANSAS CITY. *Secretary*, James E. McConchie, M.D., First National Bank Bldg., Independence, Mo. Meets last Friday of each month.

ST. LOUIS SOCIETY OF RADIOLOGISTS. *Secretary*, Wm. B. Seaman, M.D., 510 South Kingshighway, St. Louis 10. Meets on fourth Wednesday, October to May.

Montana

MONTANA RADIOLOGICAL SOCIETY. *Secretary*, Grant P. Raitt, M.D., 413 Medical Arts Bldg., Billings. Meets annually.

Nebraska

NEBRASKA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, James F. Kelly, Jr., M.D., 816 Medical Arts Bldg., Omaha. Meets third Wednesday of each month at 6 P.M. in Omaha or Lincoln.

New England

CONNECTICUT VALLEY RADIOLOGICAL SOCIETY. *Secretary*, B. Bruce Alicandri, M.D., 20 Maple St., Springfield, Mass. Meets second Friday of October and April.

NEW ENGLAND ROENTGEN RAY SOCIETY. *Secretary*, Stanley M. Wyman, M.D., Massachusetts General Hospital, Boston 14. Meets monthly on third Friday, at the Harvard Club, Boston.

New Hampshire

NEW HAMPSHIRE ROENTGEN SOCIETY. *Secretary*, Albert C. Johnston, M.D., 127 Washington St., Keene.

New Jersey

RADIOLOGICAL SOCIETY OF NEW JERSEY. *Secretary*, Carye-Belle Henle, M.D., 195 N. 7th St., Newark. Meets at Atlantic City at time of State Medical Society and midwinter in Elizabeth.

New York

BUFFALO RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Mario C. Gian, M.D., 610 Niagara St., Buffalo 1. Meets second Monday, October to May.

CENTRAL NEW YORK ROENTGEN SOCIETY. *Secretary*, Dwight V. Needham, M.D., 608 E. Genesee St., Syracuse 2. Meets in January, May, and October.

KINGS COUNTY RADIOLOGICAL SOCIETY. *Secretary*, Solomon Maranov, M.D., 1450 51st St., Brooklyn 19. Meets fourth Thursday, October to April (except December), at 9:00 P.M., Kings County Medical Bldg.

NASSAU RADIOLOGICAL SOCIETY. *Secretary*, Frank Huber, M.D., 131 Fulton Ave., Hempstead, N. Y. Meets second Tuesday, February, April, June, October, and December.

NEW YORK ROENTGEN SOCIETY. *Secretary*, Sidney Rubenfeld, M.D., 477 First Ave., New York 16.

NORTHEASTERN NEW YORK RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Donald H. Baxter, M.D., Albany Hospital, Albany. Meets in the capital area second Wednesday, October, November, March, and April. Annual meeting in May or June.

RADIOLOGICAL SOCIETY OF NEW YORK STATE. *Secretary-Treasurer*, Mario C. Gian, M.D., 610 Niagara St., Buffalo. Meets annually with the State Medical Society.

ROCHESTER ROENTGEN-RAY SOCIETY. *Secretary-Treasurer*, Henry H. Forsyth, Jr., M.D., 40 Meigs St., Rochester 7. Meets at Strong Memorial Hospital, 8:15 P.M., last Monday of each month, September through May.

WESTCHESTER RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Maynard G. Priestman, M.D., New Rochelle Hospital, New Rochelle, N. Y. Meets third Tuesday of January and October and at other times as announced.

North Carolina

RADIOLOGICAL SOCIETY OF NORTH CAROLINA. *Secretary*, Waldemar C. A. Sternbergh, M.D., 1400 Scott Ave., Charlotte 2. Meets in April and October.

North Dakota

NORTH DAKOTA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, H. Milton Berg, M.D., Quain & Ramstad Clinic, Bismarck. Meets in the Spring with State Medical Association; in Fall or Winter on call.

Ohio

OHIO STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, M. M. Thompson, Jr., M.D., 316 Michigan St., Toledo.

CENTRAL OHIO RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Howard W. Bangs, 1381 West Sixth Ave., Columbus 12. Meets second Thursday, October, December, February, April, and June, 6:30 P.M., Columbus Athletic Club, Columbus.

CLEVELAND RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Mortimer Lubert, M.D., Heights Medical Center Bldg., Cleveland Heights 6. Meets at 6:45 P.M. on fourth Monday, October to April, inclusive.

GREATER CINCINNATI RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Chapin Hawley, M.D., 927 Carew Tower, Cincinnati 2. Meets first Monday of each month, September to June, at Cincinnati General Hospital.

MIAMI VALLEY RADIOLOGICAL SOCIETY. *Secretary*, W. S. Koller, M.D., 60 Wyoming St., Dayton. Meets monthly, second Friday.

Oklahoma

OKLAHOMA STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John R. Danstrom, M.D., Medical Arts Bldg., Oklahoma City.

Oregon

OREGON RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John Wayne Loomis, M.D., 919 Taylor Street Bldg., Portland 5. Meets monthly, second Wednesday, October to June, at 8:00 P.M., University Club, Portland.

Pacific Northwest

PACIFIC NORTHWEST RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. Richard Raines, M.D., 214 Medical-Dental Bldg., Portland 5, Ore. Meets annually in May.

Pennsylvania

PENNSYLVANIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, James M. Converse, M.D., 416 Pine St., Williamsport 8. Meets annually.

PHILADELPHIA ROENTGEN RAY SOCIETY. *Secretary*, Herbert M. Stauffer, M.D., Temple University Hospital, Philadelphia 40. Meets first Thursday of each month at 5:00 P.M., from October to May, in Thompson Hall, College of Physicians.

PITTSBURGH ROENTGEN SOCIETY. *Secretary-Treasurer*, Donald H. Rice, M.D., 4800 Friendship Ave., Pittsburgh 24. Meets monthly, second Wednesday, at 6:30 P.M., October to May, at the Hotel Roosevelt.

Rocky Mountain States

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John H. Freed, M.D., 4200 East Ninth Ave., Denver 7, Colo.

South Carolina

SOUTH CAROLINA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*. William A. Klauber, M.D., Self Memorial Hospital, Greenwood. Meets with State Medical Association in May.

South Dakota

RADIOLOGICAL SOCIETY OF SOUTH DAKOTA. *Secretary-Treasurer*, Donald J. Peik, M.D., 303 S. Minnesota Ave., Sioux Falls. Meets during annual meeting of State Medical Society.

Tennessee

MEMPHIS ROENTGEN CLUB. *Secretary*, Harvey Thompson, M.D., 899 Madison Ave. Meets first Monday of each month at John Gaston Hospital.

TENNESSEE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, George K. Henshall, M.D., 311 Medical Arts Bldg., Chattanooga 3. Meets annually with State Medical Society in April.

Texas

DALLAS-FORT WORTH RADIOLOGICAL CLUB. *Secretary*, Otto H. Grunow, M.D., 650 Fifth Ave., Fort Worth 4, Texas. Meets monthly, third Monday, 6:30 P.M., at the Greater Fort Worth International Airport.

HOUSTON RADIOLOGICAL SOCIETY. *Secretary*, Harry Fishbein, M.D., 324 Medical Arts Bldg., Houston 2.

SAN ANTONIO-MILITARY RADIOLOGICAL SOCIETY. *Secretary*, Hugo F. Elmendorf, Jr., M.D., 730 Medical Arts Building, San Antonio 5, Texas. Meets at Brook Army Medical Center, the first Monday of each month.

TEXAS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. P. O'Bannon, M.D., 650 Fifth Ave., Fort Worth. Next meeting Jan. 29–30, 1954, Dallas.

Utah

UTAH STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Angus K. Wilson, M.D., 343 S. Main St., Salt Lake City 1. Meets third Wednesday, January, March, May, September, November.

Virginia

VIRGINIA RADIOLOGICAL SOCIETY. *Secretary*, P. B. Parsons, M.D., 1308 Manteo St., Norfolk 7.

Washington

WASHINGTON STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Eva L. Gilbertson, M.D., 1317 Marion St., Seattle 4. Meets fourth Monday, September through May, at 610 Pine St., Seattle.

West Virginia

WEST VIRGINIA RADIOLOGICAL SOCIETY. *Secretary*, W. Paul Elkin, 515–519, Medical Arts Bldg., Charleston. Meets concurrently with annual meeting of State Medical Society, and at other times as arranged by Program Committee.

Wisconsin

MILWAUKEE ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, Jerome L. Marks, M.D., 161 W. Wisconsin Ave., Milwaukee 1. Meets monthly on fourth Monday at the University Club.

SECTION ON RADIOLOGY, STATE MEDICAL SOCIETY OF WISCONSIN. *Secretary*, Abraham Melamed, M.D., 425 E. Wisconsin Ave., Milwaukee 2. Meets in October with State Medical Society.

UNIVERSITY OF WISCONSIN RADIOLOGICAL CONFERENCE. Meets first and third Thursday at 4 P.M., September to May, Service Memorial Institute.

WISCONSIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, W. W. Moir, M.D., Sheboygan Memorial Hospital, Sheboygan.

Puerto Rico

ASOCIACIÓN PUERTORRIQUEÑA DE RADIOLOGÍA. *Secretary*, Rafael A. Blanes, M.D., Box 9724 Santurce, Puerto Rico.

CANADA

CANADIAN ASSOCIATION OF RADIOLOGISTS. *Honorary Secretary-Treasurer*, D. L. McRae, M.D., *Assoc. Hon. Secretary-Treasurer*, Guillaume Gill, M.D. *Central Office*, 1555 Summerhill Ave., Montreal 25, Quebec. Meets in January and June.

LA SOCIÉTÉ CANADIENNE-FRANÇAISE D'ELECTRO-RADIOLOGIE MÉDICALES. *General Secretary*, Ls Ivan Vallée, M.D., Hôpital Saint-Luc, 1058 rue St-Denis, Montreal 18. Meets third Saturday of each month.

L'ASSOCIATION DES RADIOLOGISTS DE LA PROVINCE DE QUEBEC. ASSOCIATION OF RADIOLOGISTS OF THE PROVINCE OF QUEBEC. *Secretary*, Jean-Pierre Jean, M.D., 4039 Tupper St., Westmount, Que. Meets four times a year.

CUBA

SOCIEDAD DE RADIOLOGÍA Y FISIOTERAPÍA DE CUBA. *Secretary*, Dr. Rafael Gómez Zaldívar. Offices in Hospital Mercedes, Havana. Meets monthly.

MEXICO

SOCIEDAD MEXICANA DE RADIOLOGÍA, A. C. *Headquarters*, Calle del Oro, Num. 15, Mexico 7, D. F. *Secretary General*, Dr. Eugenio Toussaint. Meets first Monday of each month.

PANAMA

SOCIEDAD RADIOLÓGICA PANAMEÑA. *Secretary-Editor*, Luis Arrieta Sánchez, M.D., Apartado No. 86, Panama, R. de P.

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ROENTGEN DIAGNOSIS

THE HEAD AND NECK

Cerebral Angiography: A Diagnostic Aid in the Study of Diseases of the Brain. Irving O. Dein, Lewis L. Levy, Richard P. Schmidt, and Ephraim Roseman. South. M. J. **46**: 942–946, October 1953.

A summary of the procedure of cerebral angiography, its method, indications, contraindications, reactions, and interpretation, is presented.

Cerebral angiography is indicated particularly in any vascular lesion in the anterior two-thirds of the brain, including arterial and arteriovenous aneurysms as well as blood vessel tumors. It may aid in the study of thrombotic and embolic lesions and in the localization of tumors. In any type of expanding lesion of the brain an arteriogram may be valuable.

There are very few contraindications to arteriography. The most important is severe arterial disease of the brain, particularly advanced arteriosclerosis. The reaction most often observed is severe burning pain in the face and head on the side and at the time of injection. Non-fatal complications of a transitory nature include hemiparesis of varying degree, convulsions, minor fever, allergic reactions, petechiae of the face, cervical hematoma, radiculitis of the cervical roots, and irritation or paralysis of the cervical sympathetics. Non-fatal complications of a permanent nature include hemiplegia or accentuation of a pre-existing hemiparesis.

Fatal complications are seen occasionally in patients with subarachnoid hemorrhage, in whom bleeding may be induced. Rarely, respiratory failure and subsequent death may occur in an individual with a normal cerebral vascular system.

One must be thoroughly familiar with the appearance of the normal arteriovenous system before interpreting an abnormal picture. Vascular anomalies, including aneurysms, appear as radiopaque densities. Expanding lesions distort the position of blood vessels; contracting lesions, such as areas of encephalomalacia, may pull the vessels toward the pathologic tissue. Expanding lesions of the frontal lobe increase the distance between the anterior and middle cerebral vessels as seen in the anteroposterior view. Tumors of the temporal lobes push the internal carotid and middle cerebral vessels upward and toward the mid-line.

Eight roentgenograms; 2 drawings.

THEODORE E. KEATS, M.D.
University of California

Simultaneous Biplane Cerebral Roentgenography. William B. Seaman, Wendell G. Scott, and William D. Henry. Am. J. Roentgenol. **70**: 445–448, September 1953.

For complete visualization of the ventricular system following the introduction of air into the ventricles or subarachnoid space, multiple films in various positions are indispensable. Since complete filling of the ventricles is rarely, if ever, obtained, it is necessary to manipulate the head in order to move the air from one ventricle to another. To obtain the proper three-dimensional perspective, roentgenograms in both the frontal and lateral projections are necessary. The head must not be moved till both lateral and frontal views in any given position are taken, since any motion will disturb the relationships of the intracranial air shadows and make their accurate identification and localization impossible.

By modifying the biplane rapidograph designed by Scott (see Radiology **53**: 846, 1949), the authors have been able to use it for ventriculography and encephalography. With simultaneous frontal and lateral exposures, the procedure has been shortened in time and the patient's comfort has been increased by elimination of some of the manipulation.

The routine ventriculographic examination includes four pairs of projections: (1) anteroposterior and lateral views with the face up, (2) postero-anterior and lateral views with the face down, (3) anteroposterior and lateral views with the right side up, (4) postero-anterior and lateral views with the left side up.

A description of the equipment is included.

Eight roentgenograms; 2 photographs.

HOWARD NEUCKS, M.D.
Indiana University

The Roentgenographic Aspects of Thrombosis of Aneurysms of the Anterior Communicating and Anterior Cerebral Arteries. Bernard S. Epstein. Am. J. Roentgenol. **70**: 211–217, August 1953.

The angiographic diagnosis of intracranial aneurysms is firmly established, but reports of closure of such aneurysms by thrombus are rare. The author was unable to find in the literature any case in which thrombosis of an intracranial aneurysm was demonstrated roentgenologically.

Three cases are reported here, all with similar angiographic and pneumoencephalographic findings. One was confirmed at necropsy. In this instance the angiograms revealed a block of the anterior cerebral artery at the junction with the anterior communicating artery. The ophthalmic and middle cerebral arteries were well filled. Air studies showed a mass bulging into the cisterna chiasmatis. After a few minutes an air pocket was present beneath the frontal lobe. These findings were interpreted as indicating a mass lesion in the vicinity of the chiasm, with disruption of the cortex of the inferior surface of the left frontal lobe, which permitted gas to seep through into the subfrontal subarachnoid region. Death, in coma, occurred a few hours after the air studies.

Necropsy revealed an aneurysm at the junction of the anterior cerebral and anterior communicating arteries (mass shadow). A thrombus in this aneurysm extended up the anterior cerebral artery, occluding it. The frontal lobe was infarcted and there was a rent in the infarct.

In the other two cases the angiographic findings were similar. A mass was seen in the cisterna chiasmatis on the air studies, but there was no tear in the frontal lobe allowing ventricular air to escape. These two patients were not operated on.

The author suggests that, where angiograms reveal a block as described, and an aneurysm does not fill with the contrast medium, an air study should be done. If a mass extending into the cisterna chiasmatis is found, and the cisternae interpeduncularis and pontis are unchanged, the presumptive diagnosis is aneurysm con-

taining a thrombus occluding the anterior cerebral artery.

Ten roentgenograms; 4 photographs.

GEORGE R. KRAUSE, M.D.
Mt. Sinai Hospital of Cleveland

Late Meningeal Reaction to Ethyl Iodophenylundecylate Used in Myelography. Report of a Case that Terminated Fatally. Theodore C. Erickson and Hans J. van Baaren. J.A.M.A. **153:** 636–639, Oct. 17, 1953.

A 33-year-old male had symptoms and signs suggesting a spinal cord lesion. Myelography was performed with 6 c.c. of ethyl iodophenylundecylate (Pantopaque). No abnormality was discovered. Headache and transient fever of 102.2° F. were noted on the following day. Exploratory laminectomy two weeks later revealed an hemangioma of the spinal cord extending from the 9th thoracic to the 1st lumbar level. There was symptomatic improvement postoperatively except for occasional headache. During the fifteenth postoperative month the headaches increased rapidly in severity and the patient became lethargic, vomited, and was incontinent. Skull films showed iodized oil scattered through the posterior fossa, the cisterns about the sella turcica, and the subarachnoid spaces. Ventriculography indicated an obstruction in the fourth ventricle. Craniotomy disclosed a complete block of the lower portion of the fourth ventricle due to a mass of meningeal and cerebellar tissue infiltrated with neutrophils and lymphocytes. The patient died on the second postoperative day. Postmortem examination showed meningeal hyperemia and a fibrinous exudate over the basal surface of the brain and over the lower thoracic portion of the spinal cord. Gross and microscopic diagnoses were: arachnoiditis or chronic meningitis producing severe internal hydrocephalus.

Chemical analysis of the material from the basal surface of the medulla showed nearly 50 mg. iodine per 100 gm. of material. The normal iodine content of the whole body is only 20 to 50 mg. All other etiological causes for the meningitis were eliminated as completely as possible.

Although such a reaction to intracranial Pantopaque is most unusual, this report emphasizes the possibility of similar late reactions occurring in milder form and therefore being overlooked. When myelography is being performed, special attention to technic should be observed in order that Pantopaque may not escape into the skull and all of the medium should be removed following the examination.

One roentgenogram; 6 photographs and photomicrographs.

RICHARD F. MCCLURE, M.D.
Palos Verdes Estates, Calif.

Roentgenologic Aspects of Lethal Granulomatous Ulceration of the Midline Facial Tissues. Robert M. Geist, Jr., and Wylie H. Mullen, Jr. Am. J. Roentgenol. **70:** 566–571, October 1953.

Lethal granulomatous ulceration of the mid-line facial tissues is a chronic destructive inflammatory process which progresses in a period of a few months to a fatal termination. It is an uncommon disease, less than 100 cases appearing in the literature since the first description in 1896. When a generalized periarteritis is associated with a lethal granuloma, the syndrome is known as Wegener's granuloma. The etiology is unknown. Histologically, the findings are those of a nonspecific chronic inflammation.

The first symptoms are intermittent unilateral nasal obstruction and rhinorrhea. There may be found a small ulceration of the nasal mucosa that may undergo temporary healing. Complete nasal occlusion and local destruction of cartilage and bone eventually appear. Pain is absent. Prolonged low-grade fever is a characteristic symptom. Laboratory findings are normal except for an occasional leukopenia and elevated sedimentation rate. Death from inanition or hemorrhage usually occurs within six to twenty-four months. Those cases associated with periarteritis usually have a shorter and more severe course.

The diagnosis is established by biopsy (which may accelerate the disease process) or by exclusion. A differential diagnosis must include syphilis, tuberculosis, agranulocytosis, mycotic diseases, yaws, leprosy, rhinoscleroma, leishmaniasis, gangosa, and neoplasm.

Roentgenologically, the disease is characterized by a unilateral soft-tissue nasal mass. The accessory nasal sinuses on the involved side frequently show varying degrees of opacity. This is usually due to secondary infection as a result of obstruction. As the lesion progresses, destruction of bone becomes evident. The usual extensive soft-tissue swelling of the nose and adjacent tissue may be of some help in differentiating the disease from neoplasm. Pulmonary and gastrointestinal findings are present in the cases associated with generalized periarteritis.

Many types of therapy have been tried, but there are no reports of cure.

The authors have seen 5 cases of this disease and present 3 of them. In one case, in a 31-year old male, there was associated arteritis. Barium studies of the small intestine revealed multiple dilated edematous loops, similar in appearance to mesenteric thrombosis, most marked in the jejunum. A roentgenogram of the chest showed a fine diffuse nodular interstitial infiltration. Another case was that of a 17-year-old girl. Roentgen therapy (1,200 r) to the nasal cavity was given with no significant change.

Seven roentgenograms.

SEYMOUR A. KAUFMAN, M.D.
Boston, Mass

THE CHEST

Significance of a Solitary Mass in the Lung. C. Allen Good, Robert T. Hood, Jr., and John R. McDonald. Am. J. Roentgenol. **70:** 543–553, October 1953.

One hundred and fifty-six cases in which pulmonary resection was done for a solitary lung mass were studied by the authors. The patients gave no indication of significant pulmonary disease roentgenologically, other than the mass, and there was no evidence of bronchial obstruction or cavitation. Any study of this type must of necessity be of selected cases, since many patients with a solitary mass are not operated upon, for any one of a number of reasons: there may be a known extrapulmonary cancer, surgery may be inadvisable, the lesion may be calcified, or operation may be refused. The method of selection employed, however, does provide for study of a group of cases representative of the problem which confronts the physician who first examines the patient.

Classification of Lesions: The cases studied were classified microscopically. Fifty-five of the lesions, or 35 per cent, were found to be malignant. Twelve cases

of bronchial adenoma were included in this group, since metastases are known to occur in 5 to 10 per cent of these cases. Seventeen of the malignant lesions were metastatic from neoplasms that were known to exist prior to operation. The presence of an extrapulmonary cancer, however, should not, in selected cases, rule out thoracotomy, since this fact does not invariably establish a diagnosis of metastasis. Sixty-five cases were "granulomas," a chronic tissue reaction to irritation. The term "tuberculoma" was reserved for those granulomas from which the tubercle bacillus could be cultured or identified microscopically. Most of the benign neoplasms were hamartomas (25 cases). Three localized pleural mesotheliomas were included because roentgenologically they appeared to arise in the substance of the lung. A thymoma was found, completely surrounded by pulmonary tissue, a rather unusual condition.

Sex and Age: Among the patients with bronchogenic carcinoma and hamartoma, males outnumbered females. For the most part, the patients were in the "cancer age." The youngest patient with bronchogenic carcinoma was thirty-six years old, but in general likelihood of a malignant tumor increased with age.

Symptoms, laboratory tests, and skin tests were of little help in making a preoperative diagnosis.

Cytology of Sputum and Bronchial Washings: Cytologic examinations of the sputum or bronchial washings were done in 85 cases, and it is of interest that a positive diagnosis could be made in half of the cases of bronchogenic carcinoma in which this test was applied. The presence of malignant cells in the sputum depends on ulceration of the bronchial mucosa. Since the patients in this group had peripheral lesions, it was surprising that the malignant cells were found.

Bronchoscopy was done in 67 instances, and in only 4 cases was a mass seen.

Roentgenologic Aspects: The lesions were analyzed according to size, location in the lung, shape, sharpness of borders, density, homogeneity of shadow, presence of calcification, and evidence of growth. None of these features, with the exception of the last two, could be relied upon in establishing a preoperative diagnosis. Roentgenologic evidence of calcification was never found among the malignant lesions in this series. Body-section roentgenography should be employed in all cases of a solitary lung mass in an attempt to show calcification. The authors feel that this finding is highly in favor of a lesion being benign.

Evidence of an increase in the size of the lesion was found in 13 of the malignant and 6 of the benign growths. In 22 of the former group and 23 of the latter previous roentgenograms had revealed a mass.

Preoperative Diagnosis: The only reliable preoperative diagnoses were based on cytologic studies.

Operative procedures ranged from 18 pneumonectomies to 60 local excisions, with a surgical mortality rate of 1.3 per cent for the entire group of 156 cases.

On the basis of the findings in this series, it is felt that any isolated lung mass should be removed, unless thoracotomy appears unwise in the particular patient. There is no laboratory procedure or other special examination which will definitely show a lesion to be benign. Every effort should be made to demonstrate calcification, as this would seem to lessen the likelihood of malignancy.

Twelve roentgenograms; 1 table.

SEYMOUR A. KAUFMAN, M.D.
Boston, Mass.

Bronchiolar ("Alveolar Cell") Carcinoma of the Lung. Clifford F. Storey, Kenneth P. Knudtson, and Benjamin J. Lawrence. J. Thoracic Surg. **26**: 331–403, October 1953.

The authors report a series of 37 cases of bronchiolar carcinoma, principally from the Armed Forces Institute of Pathology. In their statistical evaluations, they include 108 other cases appearing in the literature after 1947, and in some analyses they have gone back further to earlier summaries, thus drawing upon a total of 205 reported cases for their observations.

Contrary to the views of some, that such tumors have their origin in the pulmonary alveoli and spread by alveolar-cell proliferation, the present authors believe that these tumors arise in the bronchioles. They object to the term "pulmonary adenomatosis" on the ground that it implies benignity. They also reject the opinion, held by many, that the tumor is multicentric in origin.

The incidence of bronchiolar tumors is estimated as approximately 5 per cent of all pulmonary carcinomas. No racial or sex preponderance has been found, and the age distribution is considered to correspond to that of bronchial carcinoma. The symptoms and physical signs are not characteristic. Of a total of 146 cases for which the method of diagnosis was clearly given, 72 were diagnosed only at autopsy. In recent years increasing numbers of the tumors have been discovered by surgical resection, Papanicolaou smear, and various forms of biopsy.

The roentgenographic features vary widely. In slightly over one half of a group of 153 cases for which adequate information as to the roentgen findings was available, the tumors were apparently confined to one lobe at the time of their discovery. The lesion most frequently found (26 per cent of the total) was a solitary peripheral nodule. Next on the list (20 per cent) came bilateral nodular lesions of varying sizes, involving all lobes of both lungs. The picture was found to change markedly on serial films, and to mimic a wide variety of pulmonary lesions.

Metastases were found in 54 per cent of the 205 cases. Of the 110 patients with metastases, 71 per cent had involvement of the intrathoracic lymph nodes; the other 29 per cent had distant metastases only.

The authors emphasize the necessity of early excisional surgery if cures are to be obtained. They hope that, through lobectomy and other surgical procedures, there may be an amelioration of the results in this disease. Information as to the results of treatment were available in 153 of the cases reviewed: 77 per cent of the patients were already dead, and death was anticipated in at least an additional 7 per cent. Of 36 living patients, 11 still had the disease, and none of these had survived over two years. Eleven who were alive after more than two years showed no evidence of recurrent or persistent neoplasm.

Thirty-three figures (roentgenograms, specimens, and charts); 2 tables.

ARTHUR S. TUCKER, M.D.
Cleveland Clinic

Bronchiogenic Carcinoma Simulating Virus Pneumonia. Harry R. Custer and Karl P. Klassen. Ohio State M. J. **49**: 793–797, September 1953.

Of 117 cases of cancer of the lung seen in the Medical Center at Ohio State University in a five-year period, 26 had been mistakenly diagnosed and treated for some

time prior to admission as virus pneumonia. As a bronchogenic cancer grows and causes complete obstruction of a bronchus, recurrent pneumonitis or atelectasis occurs. To differentiate this from a recurrent or virus pneumonia, a complete history, thorough physical examination, and a high index of suspicion are necessary. Diagnostic aids include x-ray studies of the lungs, tracheobronchial tree and pulmonary circulation, bronchoscopy, and even exploratory thoracotomy.

Three illustrative cases are reported.

Three roentgenograms.

Bronchial Adenoma. S. M. Berger, A. G. Boreadis, and V. Kremens. J. Pediat. **43**: 417–420, October 1953.

Two cases of bronchial adenoma are presented, one in a four-year-old white male and the other in a forty-year-old white female.

The child is one of the youngest patients to have been reported. Roentgenograms revealed left lower lobe atelectasis, and bronchoscopy demonstrated an obstructing polypoid growth in the left main bronchus. A pneumonectomy was performed, and subsequent pathological examination revealed an extension of the growth into a hilar lymph node. The child was clinically well two years postoperatively.

The older patient also had atelectasis of the left lower lobe, demonstrated on the roentgenograms. A lesion was shown on bronchograms to lie within the left main stem bronchus.

Four roentgenograms.

HOWARD L. STEINBACH, M.D.
University of California

Pulmonary Adenomatosis. Case Report. H. L. Heimann and Eric Samuel. South African M. J. **27**: 934–935, Oct. 17, 1953.

A case of probable pulmonary adenomatosis in a man of sixty is reported, with emphasis on the disproportion between the physical and roentgen findings. Within a few months the patient had experienced two attacks of hoarseness and cough; hemoptysis dated back two weeks. The hoarseness proved to be due to paralysis of the left vocal cord, which led to further examination including roentgen studies of the chest. Extensive involvement of both lungs was found, with multiple patchy nodules throughout. A biopsy was performed, and the histologic features were described as those of pulmonary adenomatosis or alveolar-cell carcinoma, the former being considered more likely.

In view of the similarity of pulmonary adenomatosis to "jaagsiekte," it is of interest that the patient was a farmer and that he did have some sick sheep, but unfortunately the nature of their illness could not be ascertained.

One roentgenogram. ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Clinical Observations and Interpretations of Abnormal Air Spaces in the Lungs. A New Concept of Their Origin. Edgar Mayer and Israel Rappaport. J.A.M.A. **153**: 700–703, Oct. 24, 1953.

Clinical and pathological observations have shown that air space abnormalities in the lungs (cysts, bullae, and pneumatoceles) are common, probably increasing in frequency, and variable in appearance. They are practically always acquired and are closely related to emphysematous changes. The authors postulate that abnormal air spaces may originate on the basis of developmental defects which have arisen during the postnatal period of growth of the lungs as a result of metabolic disturbances interfering with their normal development. Severe insufficiencies of pancreatic, hepatic, and pituitary origin are commonly associated with cystic and bronchiectatic changes in the lungs, and it is logical to assume that metabolic changes of lesser degree may interfere to a lesser extent with postnatal lung development and produce latent developmental defects which, in turn, may evolve into abnormal air spaces.

There is suggestive evidence that developmental defects imply a disturbance in the autonomic regulation of the visceral lung function, and in this sense abnormal air spaces may be regarded as manifestations of disturbed visceral lung function restricted to localized areas. Since this function does not begin until birth, abnormal air spaces can be acquired only postnatally.

The authors believe that check-valve obstruction brings about excessive hyperinflation only in the presence of abnormal air spaces at the site affected, and that check-valve obstruction is not the sole factor in the mechanical overdistention of abnormal air spaces. Before this mechanical distention occurs, abnormal air spaces form through coalescence of normal air spaces resulting from loss of alveolar partitions. Air space disorder, then, is defined as a loss of air space partitioning due to lack of alveolar structure in lung defects of developmental or pathological origin.

An outstanding clinical feature of air space disorder is its frequent presence without clinical manifestions when the roentgenographic evidence is most marked; contrariwise, it may be clinically most conspicuous when the roentgenographic evidence is discernible only with great difficulty.

Localized and diffuse air space disorders are ordinarily well compensated by available intact lung parenchyma, affording adequate visceral function. Bronchial obstruction interferes with this compensatory function and leads to mechanical hyperinflation of localized air spaces and eventually to pulmonary insufficiency. Modern thoracic surgery meets this situation by resecting affected lung segments and making available for compensation the functioning adjacent lung areas. RICHARD F. MCCLURE, M.D.
Palos Verdes Estates, Calif.

Pulmonary Interstitial Emphysema. G. Herrnheiser and J. P. Whitehead. Brit. J. Radiol. **26**: 519–524, October 1953.

Pulmonary interstitial emphysema results from rupture of an air sac or bronchus into the lung tissue. It is mainly caused by contusions to the chest. The air may spread to the pleura, where a vesicle may be formed and rupture, resulting in pneumothorax, or it may spread mesially, causing mediastinal emphysema. On the other hand, it may remain localized, disrupting the lung pattern, forming pseudocysts. There may be associated hemorrhage.

Radiological evidence of pulmonary interstitial emphysema may be given not only indirectly by the presence of mediastinal emphysema or of a pneumothorax, but also directly by radiological signs in the lung. These may be observed either within an opacity caused by pulmonary hemorrhage or outside it. They are easier to perceive when the air is enclosed in sizable spaces.

The following appearances have been observed: (*a*) translucencies surrounded by a very thin wall, similar to emphysematous bullae; (*b*) translucencies surrounded by a slightly thicker marginal zone, suggestive of "air-filled pseudocysts"; (*c*) translucencies with a characteristic sinuous outline, as if formed by a number of smaller vesicles. Small vesicles arranged like a "string of pearls" around bronchi (Westermark) are difficult to distinguish from the normal bronchovascular pattern. Cases of this kind may still often elude radiological recognition.

The authors describe 2 cases, in one of which necropsy was performed.

Six roentgenograms; 2 photomicrographs.

SYDNEY J. HAWLEY, M.D.
Seattle, Wash.

Pulmonary Resection in the First Year of Life. E. S. Crossett and Robert R. Shaw. Surg., Gynec. & Obst. **97**: 417–424, October 1953.

The indications for pulmonary resection in the first year of life are discussed, and 6 cases are presented in which there was no operative mortality. With the advances which have been made in anesthesia, surgical technic, antibiotics, and knowledge of respiratory physiology, it is now possible to perform pulmonary resections in infants with a high degree of safety.

In 3 cases resection was done for *congenital pulmonary cysts*. The respiratory symptoms were severe, and in each instance the roentgenogram showed a marked translucency in one hemithorax, with shifting of the mediastinum to the other side. Congenital pulmonary cysts must be differentiated from tension pneumothorax, localized hypertrophic emphysema, and congenital diaphragmatic hernia. The absence of a shadow showing the margin of the collapsed lung suggests a cyst rather than pneumothorax, which is rare in infants. In localized hypertrophic emphysema, there are fine linear shadows through the translucent area representing trabeculae. In hernias, the roentgenogram will show small gas bubbles, collapsed lung, and displacement of the heart away from the affected side.

Cysts occasionally become infected so that the patient may have a complicating empyema or pulmonary abscess. In cases in which a supposed empyema cavity fails to collapse or there is continued leakage of air with drainage, a cyst should be suspected.

One of the authors' patients had a *localized fetal atelectasis*. In such cases, an abnormal cohesion of the bronchial walls has been held responsible for failure of the lung to expand normally. The aspiration of meconium has also been implicated etiologically. This was believed to play a role in the case reported here.

Two patients had *bronchiectasis with cystic pancreatitis*, and lobectomy was done in hope of controlling the pulmonary disease. In neither case was a fatal outcome prevented.

Localized hypertrophic emphysema is still another indication for resection. This affects a segment or lobe of the lung, which is enlarged to many times normal volume by a uniform dilatation of the air sacs, as differentiated from one balloon-like space in a cyst. A case reported by Shaw (Pediatrics **9**: 220, 1952. Abst. in Radiology **60**: 113, 1953) is cited.

Fourteen roentgenograms.

MORTIMER R. CAMIEL, M.D.
Brooklyn, N. Y.

The Roentgen Localization of the Bronchopulmonary Segments by Means of Laminagraphy, Particularly in Lung Tuberculosis. Hugo Adler. Am. J. Roentgenol. **70**: 218–225, August 1953.

The author points out the importance of accurate localization of a tuberculous process in the lung because of the increasing use of segmental resection. He recommends the routine use of postero-anterior and lateral laminagrams and presents a chart comprising a series of diagrams showing the appearance of the segments in these projections. The depth of the lesions is indicated on the chart, and descriptions of each segment are given in the text.

Routine postero-anterior and lateral roentgenograms do not usually show the bronchus leading to the diseased segment. Accordingly, it is suggested that oblique laminagrams be obtained, with the body rotated so that the lesion and the hilus are in the same horizontal plane. Thus it is hoped to show the bronchus, the pulmonary focus, and cavity in a single plane.

In so far as the bronchi are concerned, the author states that usually the segmental bronchus is not filled with air in deep inspiration, except when there are pathologic changes in the area. He hypothesizes that this may be due to thickening and functional damage of the bronchial wall. There may be narrowing of the lumen and irregularities of the wall, the lateral sometimes being beaded. If there is consolidation around the bronchus, the air content stands out quite well.

[It is unfortunate that the author has supplied no roentgenograms to illustrate his findings. Certainly segmental localization of a disease process can be done with a high degree of accuracy on postero-anterior and lateral roentgenograms without laminagraphy. The latter is time-consuming and, for this purpose only, would seem to be a tedious procedure. The description of changes in the bronchial walls is interesting, but no mention is made of how frequently the results are reproducible or how often the changes can be demonstrated. No pathologic correlation is supplied.—G. R. K.]

GEORGE R. KRAUSE, M.D.
Mt. Sinai Hospital of Cleveland

The Left Main Bronchus and Its Vulnerability in Pulmonary Tuberculosis. T. W. Randall. South African M. J. **27**: 907–911, Oct. 10, 1953.

The author describes 6 cases of pulmonary tuberculosis in which scarring and contraction of the left upper lobe caused a kinking of the left main stem bronchus. This bronchial distortion causes interference with drainage from the left lower lung. Endobronchial damage or exacerbation of damage already present may occur, and ultimately stenosis of the bronchus may result. Diagnosis of this condition is based on x-ray examination, including bronchography and, if needed, tomography.

The author suggests, that if considerable distortion is found, it may be advisable to perform a one- or two-stage thoracoplasty in order to establish a more physiological condition. This may be necessary even though the upper lobe tuberculosis is apparently quiescent. If an upper lobectomy is contemplated and bronchial distortion is present, an initial thoracoplasty will help heal any possible bronchitis and provide better drainage postoperatively from the left base.

Eighteen roentgenograms.

D. D. ROSENFELD, M.D.
Fontana, Calif.

Coexistent Pulmonary Tuberculosis and Systemic Blastomycosis. Report of Case Successfully Treated with Streptomycin, Para-Aminosalicylic Acid, and Stilbamidine. Thomas C. Black and Henry M. Wilson. Am. Rev. Tuberc. **68:** 615–621, October 1953.

The authors report a case of coexistent tuberculosis and blastomycosis, a combination which is evidently quite unusual. Symptoms which later proved to be due to systemic blastomycosis began to appear fifteen months after the onset and three months after the apparent arrest of pulmonary tuberculosis. The right upper lobe was involved first by tuberculosis and then by blastomycosis. Streptomycin and PAS were used in the treatment of the tuberculous involvement, and stilbamidine was added when the diagnosis of blastomycosis was established. The pulmonary lesion of blastomycosis consisted of a dense consolidation of the upper one-third of the right upper lobe. Streptomycin and PAS produced no apparent change, but two months after treatment with stilbamidine was instituted the pulmonary lesion cleared, leaving only a slight fibrosis. At the time of this report, the patient had been clinically well for sixteen months.

Five roentgenograms; 1 photomicrograph; 1 photograph.

JOHN H. JUHL, M.D.
Minneapolis, Minn.

Active Chronic Pulmonary Histoplasmosis. W. D. Sutliff, Felix Hughes, Elizabeth Ulrich, and Luther L. Burkett. Arch. Int. Med. **92:** 571–586, October 1953.

The authors present 4 cases of active chronic pulmonary histoplasmosis, which they compare with 7 cases selected from the literature. The data collected indicate a similarity of clinical manifestations.

The infection is found among country dwellers in the Mississippi Valley. These patients complain of chronic cough, malaise, loss of weight, and fever lasting from a few months to several years. Roentgen examination shows lesions, for the most part in the upper lobes of the lungs, similar to those of chronic pulmonary tuberculosis, as a rule fibrocavitary in appearance. Specific examinations for evidence of tuberculosis usually yield negative results. Diagnosis depends primarily upon demonstration of *H. capsulatum* in resected pulmonary tissue or repeatedly in the sputum.

The course is benign and is not altered by medical therapy. Surgical excision of involved pulmonary tissue was done in 3 of the authors' cases, with early favorable results in 2.

Six roentgenograms; 3 tables.

THEODORE E. KEATS, M.D.
University of California

The Pulmonary Manifestations of Disseminated Lupus Erythematosus. Harold L. Israel. Am. J. M. Sc. **226:** 387–392, October 1953.

The collagen diseases are disorders of the connective tissue of the body, usually involving multiple organs. Pulmonary involvement has been described in each of the principal collagen diseases: rheumatic fever, periarteritis nodosa, disseminated lupus erythematosus, scleroderma, and dermatomyositis. The pulmonary manifestations of lupus erythematosus, however, have received little attention and the frequency of pulmonary involvement has not been emphasized in the literature.

The author presents 22 cases of disseminated lupus erythematosus, 20 of which showed either roentgenologic or pathologic evidence of pulmonary or pleural involvement. The most common manifestation was a non-specific pneumonia (17 cases), which occurs not only as a terminal event, but is frequently a recurrent or migrating process. In 2 patients the manifestations of pulmonary disease were predominantly respiratory. One had lesions simulating tuberculosis. A pleural effusion was present in 2 cases.

The pneumonia was either lobar or patchy in distribution and in most instances responded to antibiotic therapy. The diffuse perivascular or vascular changes and chronic interstitial pneumonia which have been considered characteristic of the collagen diseases occurred in only 1 patient.

Two roentgenograms; 2 tables.

DANIEL WILNER, M.D.
Atlantic City, N. J.

Diffuse Interstitial Fibrosis of the Lungs. M. Murray Schechter. Am. Rev. Tuberc. **68:** 603–614, October 1953.

Two cases are reported in which diffuse interstitial fibrosis (Hamman-Rich syndrome) resulted in death by asphyxiation. One patient responded well to corticotropin but died suddenly after withdrawal of that drug and of cortisone. The pulmonary findings as noted on early roentgenograms cleared almost completely along with clinical improvement on cortisone, but reappeared after the acute relapse. Pathologic findings were limited chiefly to the lungs, which showed varying stages of fibrosis in the interstitial tissues with absence of cellular infiltrate in the alveoli and bronchioles. The second patient gave a long history of progressive dyspnea, and the course was unaltered by corticotropin. Histopathologic findings were similar to those noted in the first case. No etiologic agent could be found in either case.

Roentgen findings were quite similar in the two cases and consisted of hilar fullness with a somewhat reticular network of increased density radiating outward from the hilus on either side. The peripheral lung fields were relatively clear and the involvement was symmetrical.

The author feels that the interstitial fibrosis in these and similar cases which have been previously reported may be the end-result of a number of pulmonary diseases without similar etiologic agents.

Five roentgenograms; 1 photograph; 3 photomicrographs.

JOHN H. JUHL, M.D.
Minneapolis, Minn.

Chronic Bronchopulmonary Disease Due to Inhalation of Sulfuric Acid Fumes. Alfred Goldman and William T. Hill. Arch. Indust. Hyg. & Occup. Med. **8:** 205–211, September 1953.

A forty-year-old white man, previously healthy, was accidentally exposed to liquid oleum (fuming sulfuric acid) and for eight minutes to sulfuric acid mist and fumes from the action of water on the oleum. He was severely burned about the face and body. Respiratory difficulty developed immediately, requiring ten days of oxygen therapy and six weeks of hospitalization. Eighteen months later the patient had a disabling pulmonary fibrosis, residual bronchiectasis, and pulmonary emphysema.

In view of the experimental work on animals, this

case suggests the following sequence of events. The immediate effect of the fumes was edema of the larynx and tracheobronchial tree and probably pulmonary edema. Partial atelectasis of the left lower lobe occurred early. Large amounts of white, frothy, and hemorrhagic sputum were present early in the disease, denoting necrosis and mucinous degeneration of the bronchial epithelium. Secondary infection occurred, and multilobe bronchiectasis developed, being most marked in the left lower lobe. Interstitial fibrosis and pulmonary emphysema resulted. It appears likely that these changes in the bronchopulmonary tract are permanent, since they had persisted for eighteen months.

The lesions described in this patient are similar to changes occurring in guinea-pigs exposed to sublethal doses of sulfuric acid mist. It is unlikely, however, that chronic changes will often result in humans, for sulfuric acid fumes are so irritating that workers cannot remain in such an atmosphere.

Two roentgenograms; 3 photomicrographs; 1 photograph.

Mediastinal Tumors. James M. Christie and Irving Weissman. Illinois M. J. **104:** 242–252, October 1953.

Tumors of the mediastinum are more frequent than formerly believed, but this is undoubtedly due to improved clinical examination and the more frequent use of chest roentgenograms. In an analysis of 268 reported cases, it was found that 75 per cent of all mediastinal tumors are of three main types: cysts (63 per cent), neuroblastomas (22 per cent), and teratoid tumors (15 per cent). The remaining 25 per cent consist of connective-tissue tumors, primary lymph-node tumors, thymomas, vascular tumors, thyroid tumors, hamartomas, and tuberculomas. It has also been shown that certain types of tumor tend to occur in certain anatomical locations. Thus, 75 per cent of anterior mediastinal tumors are of dermoid or teratoid origin; 90 per cent of those in the posterior mediastinum are neuroblastomas; 95 per cent in the superior mediastinum are either thyroid tumors or thymomas; 52 per cent of the central mediastinal tumors are bronchogenic cysts.

By utilizing all of the possible clinical and the radiographic examinations, it has been estimated that 80 per cent of mediastinal tumors can be diagnosed. Benign tumors appear on the roentgenogram as single sharply outlined round or oval masses. A bronchogenic carcinoma tends to form a unilateral mass that is usually quite dense and merges with the hilar shadow, showing a fuzzy outer border. Every effort should be made to establish identification preoperatively, but if all investigative methods fail, exploratory thoracotomy is indicated, since masses in the mediastinum are potentially a threat to life.

A series of 13 cases is presented illustrating the major types and locations of the mediastinal tumors.

Twenty-four roentgenograms.

DEAN W. GEHEBER, M.D.
Baton Rouge, La.

Traumatic Mediastinal Hematoma. Report of Two Cases. Z. F. Endress. Am. J. Roentgenol. **70:** 576–580, October 1953.

The author presents two cases of traumatic mediastinal hematoma following a "steering-wheel" type of injury. The first patient presented a lateral bulging of the mediastinum to the right. On the lateral view, no localized mass could be seen. There were no fractures and no other intrathoracic abnormalities. The second patient had, on examination, a fractured sternum with a large well defined retrosternal mass centered over the fracture line. It was felt that the difference in appearance of the hematoma in the two cases could be explained by the bodily habitus of the patients. The first was of the asthenic type with a short anteroposterior diameter, while the second was of the barrel-chested type.

Clinically, the main subjective finding was pain on respiration. The first patient had distended neck veins on admission to the hospital.

The differentiation from other mediastinal lesions may be difficult. A history of trauma, fractured ribs, pneumothorax, hemothorax, etc., should suggest a hematoma, especially if the shadow disappears on bed rest.

Seven roentgenograms.

SEYMOUR A. KAUFMAN, M.D.
Boston, Mass.

Angulation Roentgenograms in Obscure Lung Lesions: A Standardized Technique. Morris H. Sokoloff and Jacob J. Mendelsohn. Dis. of Chest **24:** 445–451, October 1953.

The authors believe that greater use should be made of oblique and lordotic chest films for demonstrating obscure pulmonary lesions. They point out, however, that these projections should be standardized so that repeat examinations can be made in identical positions. Two devices for this purpose are described. They are easily constructed and readily attached to conventional apparatus, with provision for obtaining the desired angulation.

Illustrations include photographs of the devices, detailed drawings, and reproductions of lordotic and oblique films.

HENRY K. TAYLOR, M.D.
New York, N. Y.

The Reaction of the Lung on Bronchography with Watersoluble Contrast Media in Rats: Comparison Between Two Media. B. Hellström. Acta radiol. **40:** 371–382, October 1953.

The author has previously reported experimental observations on the response of lung tissue to a watersoluble medium containing carboxymethylcellulose, namely Umbradil-Viscous B (Hellström and Holmgren. Acta radiol. **32:** 471, 1949. Abst. in Radiology **55:** 630, 1950). Studies with Joduron B, a similar preparation, were carried out by Vischer and by Werthemann and Vischer (Schweiz. med. Wchnschr. **81:** 54, 1077, 1951. Abst. in Radiology **57:** 900, 1951, and **59:** 594, 1952). Because of the widely different results as to the chronicity of the reactions with the two media, it was decided to investigate them further. White rats were used for the experiments. The opaque materials were injected through a catheter into the right lower lobe, and the animals were killed after varying intervals. Macroscopic and microscopic examinations of the injected lobes and the normal lungs were made.

Umbradil-Viscous B disappeared rapidly, and after two, three, and six months only minimal changes in the alveoli could be found. In general, the histologic picture was normal. No foreign-body reactions were observed.

With Joduron B, the initial reaction, both macroscopically and microscopically, was more pronounced, and changes were present in many of the animals six months following the injection. At that time, in certain animals, the contrast material was found in ectatic cavities.

The author concludes that, in bronchography with these water-soluble preparations, the iodized contrast medium proper is rapidly absorbed, but this is not true of the viscous component, in spite of its water solubility. Since carboxymethylcellulose is the viscous element of both media, it is not easy to understand the difference in reaction. Joduron B, however, is five times more viscous than Umbradil, and it may occlude small bronchial tubes for a long period. The consequent atelectasis may prevent absorption of the carboxymethylcellulose.

Twelve photomicrographs.

LAWRENCE A. DAVIS, M.D.
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Planigraphy in Müller and Valsalva Experiments. Per Amundsen. Acta radiol. **40**: 387–394, October 1953.

Planigraphic studies during variations in intrathoracic pressure such as occur in Müller's and Valsalva's maneuvers show a change in the caliber of the azygos vein and other intrathoracic vessels. This is an aid in differentiating vascular structures from solid masses. It is especially useful in demonstrating tumors of the peripheral vessels of the lung. Variations in the central hilar vessels are more difficult to distinguish, but alterations in size and shape of the heart and vessels with pressure changes may be of assistance in deciding whether the hilar nodes are enlarged.

Seventeen planigrams and chest roentgenograms.

CLAUDE D. BAKER, M.D.
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THE CARDIOVASCULAR SYSTEM

Roentgen Diagnosis of Congenital Heart Disease with a Prominent Pulmonary Segment (Pseudoforms). P. Thurn and A. Schaede. Fortschr. a. d. Geb. d. Röntgenstrahlen **79**: 476–487, October 1953. (In German)

The authors describe several congenital cardiac and vascular anomalies with a prominent "pulmonary segment" which, however, is not formed by the pulmonary artery (pseudopulmonal segment). Such a "pseudopulmonary segment" may be found in:

A. Venous anomalies
   1. Persistent left superior vena cava emptying into the coronary sinus
   2. Persistent left superior vena cava emptying into the right superior vena cava or the right auricle
   3. All pulmonary veins emptying into the right heart
   4. Abnormal insertion of the pulmonary vein.

B. Enlarged right auricle
   5. Ebstein syndrome
   6. Aneurysm of the coronary sinus

C. Anomalies of the aorta
   7. Left ascending aorta
   8. Truncus arteriosus and truncus pulmonalis

D. Tumor

Angiocardiography and cardiac catheterization may be required for a diagnosis.

Twenty-two roentgenograms.

JULIUS HEYDEMANN, M.D.
Chicago, Ill.

Roentgenographic Diagnosis of Coarctation of the Aorta in a Two-Day-Old Infant. Dennis N. Marks, Robert S. Shapiro, and Lester G. Joseph. J. Pediat. **43**: 453–456, October 1953.

The authors present a case of coarctation in a two-day-old infant in which the diagnosis was made by direct visualization of the coarcate segment in the roentgenogram. This was seen as an indentation in the descending aorta just above the level of the left pulmonary artery. The heart was enlarged and there was increased prominence of the pulmonary vascular markings, which suggested that there was an associated left-to-right shunt in addition to the coarctation.

The infant died eighty hours after birth. Autopsy revealed a coarctation with a large patent ductus and a high interventricular septal defect.

One roentgenogram; 1 electrocardiogram; 3 drawings.

HOWARD L. STEINBACH, M.D.
University of California

The Clinical and Radiological Assessment of the Pulmonary Arterial Pressure in Mitral Stenosis. L. G. Davies, J. F. Goodwin, R. E. Steiner, and B. D. Van Leuven. Brit. Heart J. **15**: 393–400, October 1953.

Elevation of the pulmonary arterial pressure is usual in long standing mitral stenosis, especially in cases with moderate to severe symptoms. Since the degree of elevation is an important factor in deciding on valvulotomy, any help in determining the pressure by simple means is valuable.

The authors have made what appears to be a significant contribution in this study of 51 cases of mitral stenosis. Angiocardiography, electrocardiography, cardiac catheterization, and plain films were used. In most of the cases with moderate elevation of pressure (40–70 mm. Hg) and in all cases with severe elevation (over 70 mm. Hg) there were dilatation of the proximal portions of the pulmonary arteries with narrowing and tortuosity of the peripheral branches, especially in the lower lobes. The severity and extent of these changes bore a clear relation to the degree of pulmonary hypertension. In no case were changes seen in the mid-zones or apices of the lungs in the absence of concomitant basal changes, indicating that arterial narrowing begins at the bases, involving progressively more and more of the pulmonary arterial tree. It is noted that the dilatation involved the portions of the arterial tree composed chiefly of elastic tissue, while the narrowing was seen where muscular tissue predominates in the vessel walls.

The changes in the vessels seen on angiocardiograms could also be found, by careful inspection, on the plain films, and since the degree of change paralleled the elevation of pressure, both angiocardiography and cardiac catheterization can be omitted in the preoperative study of many patients with mitral stenosis. The roentgen changes were a better guide to the pulmonary arterial pressure than were the symptoms or clinical signs. Correlation with electrocardiographic changes was poor.

Twelve roentgenograms; 6 graphs.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Congenital Mitral Stenosis in an Infant. Agustín Castellanos and Otto García. Rev. cubana pediat. **25**: 471–492, August 1953. (In Spanish)

A case of congenital mitral stenosis in an infant is reported. Cardiac catheterization was not done but the angiographic findings permitted differentiation of a pure mitral stenosis from so-called "mitral disease," that is, association of stenosis and insufficiency. The authors saw a similar case with Cardelle and Martín Jiménez of Buenos Aires. The dextroangiocardiogram showed the same features (also observed by R. Kreutzer of Buenos Aires) in both infants, namely a downward and lateral displacement of the inferior branch of the right pulmonary artery by a non-opaque cardiac structure. The same structure compresses the inferior part of the superior vena cava. The levoangiocardiogram makes the differentiation easy. In both instances a large or giant left auricle was visualized, and in addition the aorta appeared hypoplastic. In congenital mitral stenosis (pure or isolated), the shadow corresponding to the left ventricle is small and its walls are always thin. In cases of associated mitral stenosis and insufficiency, the left ventricle is large and its walls are thick. The thickness of the left ventricular walls may be clearly seen in the film when the cavity of that ventricle is filled with contrast material.

Fifteen illustrations, including 9 roentgenograms.

JAMES T. CASE, M.D.
Santa Barbara, Calif.

Laevocardia with Transposition of the Abdominal Viscera. Maurice Campbell and Paul Forgacs. Brit. Heart J. **15**: 401–422, October 1953.

Complex congenital defects are the rule when the heart is on the left and the abdominal viscera are transposed. A study is presented of 14 cases seen by one of the authors and 19 others from the more recent literature. In 10 cases necropsy provided full details of the anatomical changes; 14 others were studied by angiocardiography or cardiac catheterization, providing a series of 24 for ultimate analysis.

The cases are divided into two groups, according to the location of the venous atrium on the right or left. Seven patients had the venous atrium on the left with the pulmonary veins entering the right atrium. In all these the aortic arch was right-sided. In several cases there was transposition of the aorta and pulmonary artery which would have corrected the original transposition of the atria, but it was offset by septal defects and pulmonary stenosis or atresia. Various anomalies of the systemic venous return were encountered, while abnormalities in pulmonary venous drainage were less frequent.

Transposition of the aorta and pulmonary artery in varying degrees was seen frequently in the second group, as well as in the first, and again was commonly associated with septal defects and pulmonary stenosis or atresia. In fact, septal defects were practically the rule in all cases, involving both atrial and ventricular septa. The openings ranged from very small ones to common chambers separated by a ridge.

At least one patient in the series is able to lead a relatively normal life. He was thirty-two years of age at the time of the report, acyanotic, with a mild aortic insufficiency thought to be caused by a bicuspid aortic valve.

From a practical therapeutic point of view, there was usually a diminished blood supply to the lungs and benefit was obtained in several cases from a Blalock operation.

Seventeen roentgenograms; 5 electrocardiograms; 2 photographs; 10 drawings; 3 tables.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Cardiac Aneurysm with Ventricular Tachycardia: Case Report and Brief Review of the Literature. Edward Wasserman and Jacob Yules. Ann. Int. Med. **39**: 948–956, October 1953.

Because of the indefinite clinical features, the diagnosis of cardiac aneurysm is frequently overlooked. A case is presented in which an antemortem diagnosis was made on the basis of certain physical signs, x-ray findings, and electrocardiographic changes.

The formation of a cardiac aneurysm is one of the less frequent complications following myocardial infarction. The literature reveals an incidence varying from 9 to 37 per cent. The intraventricular pressure may cause the formation of an aneurysm as healing with fibrosis progresses, unless the scar becomes strong enough or is reinforced by mural thrombi and adherent pericardium. Resultant fibrosis and thinning occur, leading to a localized cardiac dilatation. Occlusion of the descending branch of the left coronary artery, with consequent aneurysm of the anterior surface of the left ventricle or apex, is the usual pathologic finding. The apex, being most distant from the adequate blood supply, is chiefly involved. Other rarer causes of cardiac aneurysm are trauma, bacterial infection of the myocardium from either abscess or embolus, syphilitic gumma, and rheumatic myocarditis. Calcification in the wall of such aneurysms has been reported.

Symptoms, when present, are those of cardiac decompensation. The patients often undergo repeated episodes of congestive failure, and compensation is usually difficult to achieve. It is thought that the aneurysm itself does not alter the prognosis. The deciding factor appears to be the functional capacity of the remainder of the ventricle.

A helpful diagnostic sign is an abnormal palpable pulsation separate and distinct from the apical pulsation, located between the sternum and apex. Gallop rhythm in association with a dull first heart sound, together with a pulsation distinct from that of the apex, has been considered diagnostic of cardiac aneurysm. No characteristic murmurs are noted. The blood pressure is variable.

The diagnosis of cardiac aneurysm depends largely on the roentgen findings. The most characteristic feature is a localized bulge on some portion of the contour of the left ventricle. The heart is most often enlarged to the left and the apex appears blunted, producing a rectangular or square appearance. The aneurysmal pulsations, visualized by fluoroscopy or kymography, may be strong or weak, systolic or contrapulsatile, synchronous or asynchronous. Asynchronicity with contrapulsatile pulsation is seen in most cases.

Cardiac aneurysms rarely rupture. Congestive failure or myocardial infarction is the usual cause of death. Occasionally cerebral embolism occurs from a dislodged fragment of clot within the aneurysm.

The authors' patient was a 67-year-old male who had sustained a penetrating wound of the chest ten years prior to his initial myocardial infarction. It is known that trauma as well as coronary occlusion may be the cause of a cardiac aneurysm. Both of these etiologic factors were elicited in this case.

During the patient's first hospital admission, the

presence of a pulsation just medial to the apical thrust was noted. A chest roentgenogram at this time confirmed the presence of a large cardiac aneurysm. On the second admission, the electrocardiograms revealed persistent elevation of the S-T segments in Leads $V_{4,5}$ and $_6$, a finding which has recently been emphasized as diagnostic of cardiac aneurysm. The second, third, and fourth hospital admissions were necessitated by progressively severe and increasingly resistant episodes of congestive failure. During the final admission, paroxysmal ventricular tachycardia developed and was treated by quinidine. It is possible that the amount of quinidine employed was responsible for the patient's death by causing gradual irreversible prolongation of the QRS interval.

One roentgenogram; 1 electrocardiogram.

STEPHEN N. TAGER, M.D.
Evansville, Ind.

Idiopathic Congenital Dilatation of the Pulmonary Artery. Benjamin M. Kaplan, Jakub G. Schlichter, Gerald Graham, and George Miller. J. Lab. & Clin. Med. **41**: 697–707, May 1953.

Six cases of idiopathic congenital dilatation of the pulmonary artery with clinical data and right heart catheterization studies are presented. From their observations the authors have enumerated certain criteria which can establish the diagnosis clinically in most cases. Confirmation by right heart catheterization, however, is suggested in every case.

History: None of the patients sought medical advice because of any symptoms referable to the cardiopulmonary system. Rather, congenital heart disease had been diagnosed because of murmurs found incidentally on routine or unrelated examinations; 2 of the patients, on questioning, reported minor cardiorespiratory symptoms. None complained of cyanosis.

Physical Findings: None of the patients had cyanosis, clubbing, chest deformities, retardation of growth or development, abnormal peripheral pulses, or signs of congestive heart failure. The only abnormalities found on examination were related to cardiac auscultation and palpation. In each instance, the second pulmonic sound was accentuated and was greater than the second aortic. A systolic murmur was heard with maximum intensity in the second or third intercostal space to the left of the sternum. A thrill could be elicited in the same location. The only constant feature of this murmur was its very inconstancy.

Fluoroscopic and Roentgenographic Examination: Final judgment about the cardiac silhouette and the lung fields was arrived at only after correlating the findings on fluoroscopy and roentgenography. In all cases, the pulmonary artery and its main branches were large and dynamic, as was best shown in posteroanterior and right anterior oblique views. Expansile pulsations ("hilar dance") were not seen. Peripheral vascular markings were normal in each instance. The discrepancy between large hilar vessels and diminished or absent peripheral markings, as seen generally in "isolated" pulmonary stenosis with poststenotic dilatation, was not present in the authors' cases. No cardiac chamber enlargement was seen, and the aortic knob was normal.

Electrocardiogram: The electrocardiogram was within normal limits in all patients.

Cardiac Catheterization: There was no evidence of a left-to-right shunt. The arterial oxygen saturations were normal in all cases, both at rest and on exercise, indicating the absence of a right-to-left shunt. As the catheter was withdrawn from the pulmonary artery into the right ventricle, continuously recorded pressures showed a normal systolic pressure gradient. Pulmonary artery pressures were normal in all but one instance, in which there was a slight elevation.

Cardiac output and cardiac index values were normal in 5 patients both at rest and on exercise. In 1, the resting output was at the upper limit of normal at rest, with a decrease during exercise.

Respiratory Studies: Oxygen consumption at rest, measured as part of the output determinations, was within normal limits in all instances. Except in 1 case, it approximately doubled on a standard type of mild exercise, which is the response obtained from normal subjects.

The importance of differentiating idiopathic congenital dilatation of the pulmonary artery from cardiac defects correctable by surgery is stressed. It will take a long-term follow-up in patients with this condition to arrive at a prognosis with any degree of certainty.

Four roentgenograms; 4 tables.

The Recognition and Treatment of Arteriosclerotic Stenosis of Major Arteries. Edwin J. Wylie and Joseph S. McGuinness. Surg., Gynec. & Obst. **97**: 425–433, October 1953.

The clinical and pathologic characteristics of stenosis of the major arteries due to arteriosclerosis have been studied in a series of 27 cases. The subject is important because, if arterial stenosis is present in sufficient degree to cause symptoms, it may be considered as predisposing to the development of arterial thrombosis. Since the competency of the diseased vessel may be partially restored by thromboendarterectomy, it is important to be able to localize the stenosis exactly.

In 12 cases, a segmental zone of arteriosclerotic narrowing was the sole demonstrable cause of complaints of arterial insufficiency. In 6 the stenosis was an incidental arteriographic finding; in another 6 the stenotic lesion progressed to complete thrombosis; 3 were found to have significant stenosis apart from a zone of arterial thrombosis. Seventeen patients were between thirty and fifty years of age; 10 were between fifty and seventy.

In all patients the changes involved a portion of the major arterial tree between the upper abdominal aorta and the popliteal arteries.

Arteriographic studies were done *via* a modified aortography technic: 50 c.c. of 70 per cent Urokon or 70 per cent Diodrast were injected rapidly through two 7-inch, 17-gauge needles, and four 36-inch films, covering the full length of the arterial tree from the level of the diaphragm to the lower leg, were exposed serially over an eight-second interval.

Resection of the diseased intima was performed in 12 patients. The pathologic and arteriographic characteristics of the lesions encountered were found to be closely related. Significant changes in the lumen or the wall of the aorta were never observed proximal to the level of the superior mesenteric artery, and in most cases only distal to the renal arteries. In those cases in which marked stenosis was found at a level between the renal arteries and the bifurcation of the common iliac arteries, the intima over this entire area was usually involved to a variable degree by arteriosclerotic thickening and plaque formation. It was unusual to find

appreciable changes in the external iliac arteries, but when changes were found there was usually diffuse involvement of the major arteries in the legs as well. The most marked degree of stenosis was usually observed near the orifice of a major arterial branch; *i.e.*, at the level of the inferior mesenteric artery or at the bifurcation of the aorta, common iliac, and common femoral arteries. It was also observed that at a zone of stenosis, variable portions of the circumference of the artery were thickened. In some, an annular "napkin ring" lesion was present. In others, an eccentric cylindrical thickening of one wall of the artery projected sufficiently into the lumen to create a crescent-shaped lumen when examined in cross section. When the posterior wall of the artery was involved by eccentric thickening, the arteriographic picture showed decreased opacity rather than luminal narrowing. In several cases, arteriography suggested a decrease in the velocity of blood flow. This was shown by delayed filling of the artery distal to the stenotic zone.

It is suggested that the lumen of a major artery must be reduced by at least 90 per cent to produce impairment sufficient to cause ischemic symptoms distal to the level of the stenosis. In the patients studied, the symptoms could be referred to a specific arterial level. Segmental stenosis and segmental thrombosis at the same level gave similar symptoms. Stenosis of the superficial femoral artery caused calf claudication and chronic coldness of the foot. The patient with common femoral stenosis complained of severe posterior thigh muscle fatigue and walking limitation. Unilateral common iliac stenosis caused gluteal fatigue, aching pains in hip and pain in thigh muscles produced by walking and relieved by rest. In one of these patients, a diagnosis of herniated disk was considered. Bilateral common iliac stenosis gave symptoms in both extremities, often accompanied by impotence.

The article is of interest to radiologists, since the exact localization of the lesion is determined roentgenographically. Though no scout films are shown, radiologists will probably contribute to the diagnosis without arteriograms after some experience has been accumulated.

Eight figures, including 12 arteriograms.

MORTIMER R. CAMIEL, M.D.
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Congenital Aneurysm of the Right Sinus of Valsalva, Diagnosed by Aortography. Walter Falholt and Gregers Thomsen. Circulation **8:** 549–553, October 1953.

What is believed to be the first case of unruptured aneurysm of the sinus of Valsalva diagnosed during life is here reported. Diagnosis was made by means of aortography following the introduction of a cardiac catheter into the ascending aorta (see Brodén *et al.* Acta radiol. **32:** 498, 1949. Abst. in Radiology **55:** 616, 1950). After such an aneurysm has ruptured, there is a rather characteristic clinical picture, but in the absence of rupture, symptoms and signs are variable or completely absent.

The patient, a girl of seventeen, had always had some limitation of physical activity. Systolic and diastolic murmurs were present, but findings on cardiac catheterization were negative. Blood pressure was normal. Aortography demonstrated a slight aortic insufficiency and revealed a rounded shadow about the size of a walnut, below and a little in front of the aorta, with a "thin connection" extending to the right aortic sinus. This was interpreted as an unruptured aneurysm. The murmurs were thought to arise from the filling and emptying of the sac with systole and diastole.

Four roentgenograms.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Congenital Pulmonary Arteriovenous Aneurysm. Robert D. Sloan and Robert N. Cooley. Am. J. Roentgenol. **70:** 183–210, August 1953.

Congenital arteriovenous aneurysms of the lung are relatively uncommon, but have been reported with increasing frequency during the past decade. Pathologically they are similar to hemangiomatous malformations found elsewhere in the body. They are composed of endothelial-lined vascular channels and a connective-tissue stroma. The vascular channels range from capillary-sized structures to huge tubular or sacculated multilobulated dilatations. Most of the clinically significant lesions are fundamentally hemangiomas of the cavernous type, being composed of large irregular channels with thin walls and scant connective tissue. As a rule, one border presents on the pleural surface of the lung. The major arterial supply is usually from a branch of the pulmonary artery, and the veins drain into the pulmonary venous system. In most of the clinically significant aneurysms there have been large channel communications permitting varying amounts of unoxygenated blood to return to the left side of the heart.

Pulmonary arteriovenous aneurysms are frequently multiple. They do not seem to cause any disturbance of the surrounding lung parenchyma.

Physiologic disturbances depend on the amount of unoxygenated blood which is shunted from the pulmonary artery to the systemic circulation. This results in cyanosis of varying intensity. The anoxemia stimulates the erythropoietic elements of the marrow, with a polycythemic response. The sequence is similar to that produced by the anoxemia of high altitudes.

Dyspnea, resulting from anoxemia, is the most common symptom, but usually is mild. In many instances the degree of subjective incapacity is quite minimal. Cyanosis, clubbing, and a murmur over the lesion are the most common physical findings. The red blood cell count is usually elevated.

The typical lesion, as seen on routine roentgenography, is a rounded or lobulated homogeneous density within the lung parenchyma, with well defined borders, connected to the hilar region by cord-like bands. Calcification, when it occurs, is plaque-like. Pulsations are often visible. The lesion may become larger with the Müller maneuver and smaller with the Valsalva.

By far the most definitive diagnostic procedure is angiocardiography. It is justified in any case in which surgical interference is being considered in an effort to establish clearly the extent and number of aneurysms present. Laminagraphy is often of help.

Surgery is the only logical method of definitive therapy. It is certainly justified in the patient with hemoptysis or anoxemia with polycythemia due to an isolated lesion or even where there are a limited number of multiple lesions involving one or both lungs. The problem of treatment is more difficult when an isolated lesion is asymptomatic, or when multiple symptomatic lesions are so situated that large segments of pulmonary tissue must be removed in several stages.

The authors report in detail 9 of 10 cases observed

between 1940 and 1952, 7 with surgical or autopsy confirmation. These bring the total number of reported cases to about 95.

Twenty-seven roentgenograms; 2 photographs.

GEORGE R. KRAUSE, M.D.
Mt. Sinai Hospital of Cleveland

Congenital Arteriovenous Fistulae of the Hand. Raymond M. Curtis. J. Bone & Joint Surg. **35-A:** 917–926, October 1953.

The author reviews briefly the etiology and previous surgical treatment of arteriovenous fistulas. Clinical manifestations are re-emphasized and diagnostic points described. Arteriography as a special procedure to evaluate fully the extent of the presurgical lesion and the success of surgical eradication is discussed as to technic and significance.

Three cases are reported. One patient was admitted because of profuse spontaneous hemorrhage from a ruptured varix on the hand, and 2 because of pain or gangrenous changes in a single digit. All showed an increase in systolic and diastolic blood pressure, tortuous vessels, puddling and venous filling on arteriography, and non-filling of the digital arteries of the affected digit of the involved extremity. All were successfully treated by surgical removal.

The author concludes that arteriovenous fistulas in the hand are usually congenital in origin, although trauma and infection are implicated; diagnosis is best made by arteriography; pain is a constant finding; and early diagnosis and surgical intervention are necessary to prevent irreversible damage.

In a discussion of the paper Dr. Thomas W. Stevenson of New York added 3 cases of his own.

Seven roentgenograms; 6 photographs; 3 drawings.

G. ROBERT HANSON, M.D.
Cleveland City Hospital

Technique and Value of Aortography. Report of a Case of External Iliac Arterial Graft. R. E. Horton and E. M. Nanson. Brit. M. J. **2:** 969–971, Oct. 31, 1953.

Recent developments in vascular surgery have made aortography an essential in certain cases. The authors' technic is as follows. An hour before the examination "Omnopon," 1/3 gr., and scopolamine, 1/150 gr., are given and in the x-ray room a test dose of 1 ml. of 70 per cent Diodone is administered. With the patient prone on the x-ray table, a marker is fixed opposite the spinous process which is judged to be correct. If the study aims to show the iliac vessels, the injection is made opposite the third lumbar vertebra. If it is desired to demonstrate the renal vessels, the injection must be made opposite the first lumbar or twelfth dorsal vertebra to show the celiac axis and its branches.

A preliminary film is taken to check the position of the marker. A dose of 100 mg. of Pethidine is then given intravenously. The needle is inserted through a small intradermal weal and the aorta is punctured. The needle is connected to a syringe, filled with 30 ml. of 70 per cent Diodone, by an intervening length of about 12 in. of pressure tubing. The injection is given as rapidly as possible and the film is exposed as the last few milliliters are going in.

The greatest value of aortography is to define the site and extent of a block in the aorta or iliac arteries, the result of embolus or thrombosis. The authors present 4 such cases. In one of these, an external iliac arterial obstruction was accurately located by aortography. The artery was excised and replaced by an arterial graft with a satisfactory result three months after the operation.

Five roentgenograms.

DANIEL WILNER, M.D.
Atlantic City, N. J.

Intra-Aortic Procaine Injection in Aortography. Willard E. Goodwin and Robert C. Walter. Angiology **4:** 410–412, October 1953.

Commonly, following rapid intra-aortic injection of an organic iodide contrast medium in aortography the patient experiences brief cramping pain in the abdomen or extremities. This is attributed to transient arterial spasm caused by the irritating effect of the contrast substance. The authors believe that it is possible to alleviate the pain safely, and in many cases to eliminate it, by the injection of 3 to 6 c.c. of 1 per cent procaine solution through the aortography needle or tubing into the aortic stream immediately before introducing the medium. The procedure has been used in approximately 25 patients with no ill effects. There has usually been almost complete prevention of the transient cramping pain. The patients have noted only a brief wave of warmth and breathlessness as the iodide passes through the pulmonary vascular bed.

Injection of procaine is recommended as an adjunct to aortography done under local anesthesia. It may also be useful in cases of vascular disease when the examination is performed under a general anesthetic.

Mediastinal Phlebography. A Bilateral Simultaneous Injection Technique. V. Gvozdanović and B. Oberhofer. Acta radiol. **40:** 395–407, October 1953.

The authors, who are connected with the University of Zagreb (Jugoslavia), describe their technic for demonstration of the innominate veins and superior vena cava. This involves the simultaneous injection of 20 to 25 ml. of Umbradil (35 per cent) into each antecubital vein. Four serial films are obtained at one-second intervals.

Opacification of these vessels has been used by the authors principally for localizing the lower border of retrosternal and mediastinal thyroids. The procedure also aids in the diagnosis of obstruction of the large veins of the mediastinum by tumors and inflammatory processes.

Several roentgenograms are presented, showing (1) normal veins, (2) veins displaced by a mediastinal mass, and (3) collateral circulation between innominate veins and inferior vena cava.

DORIS E. PIPKIN, M.D.
University of Louisville

Splenic Venography. N. R. Konar and A. N. Sen Gupta. Brit. M. J. **2:** 810–812, Oct. 10, 1953.

In a study performed at Nilratan Sarkar Medical College, Calcutta, splenic venography was carried out in 2 control cases, in 2 patients with portal hypertension, in 3 with cirrhosis of the liver, and in 7 with splenomegaly of unknown etiology, a total of 14 patients. In an addendum 9 further instances of utilization of splenic venography are mentioned.

After preliminary sedation and with the patient supine on the table, the skin is anesthetized with 2 per cent procaine solution and a lumbar puncture needle is inserted into the spleen. "Iodoxyl" is used as a contrast medium. After 15 c.c. has been injected, a film is ob-

tained of the upper abdomen and after another 5 c.c. a second film is exposed.

Though slight hemorrhage from the spleen may result, the procedure is safe. The first patient studied vomited on injection of the medium, had a convulsion, and was febrile for several days. He had not fasted or received sedation. No other reactions are mentioned.

The venogram shows the size and patency of the splenic and portal veins. The intrahepatic branches of the portal vein are seen on normal venograms but, depending on the degree of obstruction, are either absent or very faintly visualized in cases of cirrhosis.

In portal hypertension the inferior mesenteric and left gastric veins may become visible and their prominence and tortuosity may be a measure of the degree of hypertension. In splenomegaly without portal hypertension or cirrhotic changes in the liver, the splenic and portal veins are dilated, tortuous, and faint in outline.

Five roentgenograms; 1 table.

JOHN F. RIESSER, M.D.
Springfield, Ohio

Two New Special Cannulae for the Performance of Angiocardiography and Cavography. Agustín Castellanos and Otto García. Rev. cubana pediat. **25:** 523–530, August 1953. (In English)

This article describes a set of special No. 10 Becton-Dickinson needles which were used in older children requiring very rapid injection. With these it was found possible to inject 50 c.c. in one second and 60 c.c. in 1.3 seconds. As a result of this experience the authors designed two special cannulae for the performance of angiocardiographies and superior and inferior cavographies. The first type (No. 12 B-D) consists of three pieces and a metal pilot or stilette which stops the flow of blood once the trocar is inserted into the vein. It has no external cock, so eccentric syringes may be used. By slight rotation, the trocar is firmly attached to the tip of the syringe. The cannula is 105 mm. long. The second type is a No. 10 B-D needle, similar to the one just described.

For the insertion of the needle, the authors advise the intradermic injection of 0.2 to 0.4 c.c. of 2.5 per cent Novocain. Then a small incision, 3–4 mm. long, is made in the skin over the vessel, and the cannula is introduced without its pilot or with the pilot partially set, in order to indicate when the finer piece is within the vein. After it is certain that the finest piece is correctly placed in the vessel, the cannula is totally introduced. The external piece of the cannula is connected to the syringe and the content is injected with the greatest pressure and as rapidly as possible. In order to avoid difficulty in introducing the three pieces of the cannula, the skin incision must be sufficiently large.

Five illustrations. JAMES T. CASE, M.D.
Santa Barbara, Calif.

Splenoportography. Donald R. Cooper, Robert C. Brown, Charles H. Stone, III, and L. Kraeer Ferguson. Ann. Surg. **138:** 582–590, October 1953.

This is a report of the roentgen visualization of the splenic and portal veins by injection of contrast media directly into the spleen. The authors follow the technic of Sotgiu *et. al.* (Presse méd. **60:** 1295, 1952). A No. 17 three-inch needle is inserted percutaneously at the 9th or 10th interspace and introduced into the spleen transperitoneally; 20 ml. of 75 per cent Diodrast or Uricon [Urokon?] is injected in four seconds. The first x-ray exposure is made during the fourth second. The needle is then quickly withdrawn, and four to five exposures are made, at four- to five-second intervals.

Twelve patients were examined and 6 case reports are presented, with illustrations. The procedure has been found to be valuable for determining patency of a portocaval anastomosis; for differentiation between intra- and extrahepatic portal block in patients with portal hypertension; for revealing the presence of pancreatic or other lesions which have infiltrated or blocked the splenic or portal veins. Slow emptying of the veins and increased opacity of the opaque medium, proximal to the obstruction, are two significant signs of extrahepatic block reported by Abeatici (Minerva chir. **7:** 886, 1952) and confirmed by the authors.

Splenic puncture in the presence of blood dyscrasia may result in excessive hemorrhage. That is the danger. In 4 of the authors' patients, however, undergoing laparotomy soon after splenoportography, no more than 50 c.c. of blood was found in the peritoneal cavity. In one case insertion and withdrawal of a No. 17 needle directly into a normal spleen at laparotomy resulted in about 100 ml. of blood loss into the peritoneum. The hole closed and contracted immediately. One patient, with cirrhosis of the liver and ascites experienced left upper quadrant pain and went into shock a few hours after injection. He recovered following transfusion of 1,000 c.c. of blood. Other patients had transient left upper quadrant pain.

This important paper was discussed by Alfred Blalock, Louis M. Rousselot, Charles G. Child, and Edgar J. Poth. They were in agreement that the procedure is of material aid in determining a course of surgical action. Child stated that his group performed portal venography in 85 patients and in over 100 experimental animals without untoward results. They have been using direct injection into a branch of the superior mesenteric vein at the time of operation. This may account for the lack of complications, since the technic is in a sense similar to the common procedure of injecting contrast material into an arm vein.

[We have here a method of venography by percutaneous transperitoneal intrasplenic injection of contrast material which gives us valuable information. There is, however, danger of trauma to the spleen by the needle before puncture, as well as danger of excessive bleeding after puncture. Still another danger is that the needle may be passed through the bowel. It would, therefore, seem wise to follow the technic of injecting a branch of the mesenteric vein, where surgery has been decided upon, as recommended by Child. In other cases blood study to exclude the danger of bleeding, preliminary film study of the splenic area, and fluoroscopic control during the needle insertion should be utilized. The authors are to be complimented for their courageous work in advancing the use of this procedure.—W. S.]

Sixteen roentgenograms. WILLIAM SNOW, M.D.
Shreveport, La.

Improved Method for Splenoportography Using Biplane Serialized Exposures. Giulio Tori and Wendell G. Scott. Am. J. Roentgenol. **70:** 237–241, August 1953.

The authors describe a technic of continuous high-speed serialized roentgenography which has been used to visualize the portal venous system of the dog after percutaneous injection of Urokon into the spleen.

After preliminary exposures, 20 c.c. of Urokon (70 per cent) is injected in two to three seconds and two exposures per second are made for six to ten seconds. Biplane roll-film cassettes are used, and anteroposterior and lateral views are obtained simultaneously. It is believed that the right-angle views offer a better possibility of correct interpretation of abnormalities of the portal system. The spleens of dogs examined by this technic have shown no significant histologic abnormalities after ten to thirty days (Abeatici and Campi: Acta radiol. **36:** 383, 1951. Abst. in Radiology **59:** 611, 1952).

It is believed that, with further refinement, this method may have applications in the examination of patients with primary diseases causing hepatosplenomegaly. This may be especially true in the investigation of hypertensive portal syndromes due completely or partially to obstructive phenomena. Such obstructions may be extrinsic (such as tumors) or intrinsic (such as venous thrombosis).

Four excellent roentgenograms show various phases of filling of the portal system.

GEORGE R. KRAUSE, M.D.
Mt. Sinai Hospital of Cleveland

Experimental Method for Visualization of the Hepatic Vein—Venous Hepatography. Giulio Tori and Wendell G. Scott. Am. J. Roentgenol. **70:** 242–246, August 1953.

Attempts to visualize the liver parenchyma by radiopaque suspensions, emulsions, and oils have not been too successful. Visualization through opacification of the vascular tree is more promising. Three methods are available: (1) injection of the hepatic artery (during aortography, not too satisfactory); (2) injection of the spleen (see preceding abstract); (3) retrograde visualization of the venous outflow system of the liver. The present paper describes the third of these procedures as used experimentally.

The femoral vein of an anesthetized dog is exposed. A small double-lumen Cournand catheter with a balloon over the lateral opening of one lumen is inserted and followed roentgenoscopically until the tip is 2 or 3 cm. above the diaphragm. The balloon is then inflated with a few cubic centimeters of contrast material so that it may be more easily visualized, and the catheter is secured with a suture near the site of insertion. A polyethylene catheter is introduced into the same vein until the tip is 3 or 4 c.c. below the balloon. The balloon is then fully distended to occlude the inferior vena cava. The automatic biplane roentgenographic unit with roll-film cassettes is started and, after one exposure, 20 c.c. of 70 per cent Urokon is injected rapidly through the polyethylene catheter. The hepatic veins are filled in a retrograde manner. Films are made for four or five seconds, and the balloon is then deflated.

The method has not been used in man, but the authors believe it can be developed into a practical diagnostic procedure.

Excellent reproductions of roentgenograms are included.

GEORGE R. KRAUSE, M.D.
Mt. Sinai Hospital of Cleveland

Portal Venography via the Portal and Percutaneous Splenic Routes: Anatomic and Clinical Studies. Louis M. Rousselot, Francis F. Ruzicka, and G. A. Doehner. Surgery **34:** 557–569, September 1953.

Anatomical and clinical studies of portal venography were conducted by the authors on cadavers and living subjects. The portal systems of 50 postmortem subjects were outlined with thin barium sulfate mixtures and the variations in anatomy of the portal complex—formed by the confluence of the portal, splenic, and superior mesenteric veins—were studied.

Three major anatomic types were recognized on the basis of the angle formed by the portal and splenic veins: (1) the tripod, with an angle between 90 and 140 degrees; (2) the T type; (3) the Y type. Varying points of entry of the major tributaries of the portal system—the inferior mesenteric vein and the coronary vein—were also demonstrated.

Roentgen visualization of the portal venous bed at the time of operation is done routinely in all the authors' cases of portal hypertension. This involves two types of films, namely, the splenic portogram and the portal portogram. The splenic portogram is obtained by the percutaneous injection of 40 to 50 c.c. of 70 per cent Urokon Sodium into the splenic pulp through the ninth intercostal space. The film is taken when 30 to 40 c.c. of the solution has been injected. The portal portogram is obtained by cannulizing the superior mesenteric vein and injecting 40 to 50 c.c. of a 30 per cent Urokon Sodium solution within five to seven seconds. The film exposure is made toward the end of the injection.

With these two types of examination, valuable information on anatomy, caliber, and patency of the portal and splenic veins can be obtained. This, along with certain clinical considerations, enables the surgeons to select the optimum type of shunt for the specific patient, either the portocaval or the splenorenal.

Ten roentgenograms, with accompanying drawings; 3 diagrams.

THEODORE E. KEATS, M.D.
University of California

Portocaval and Portopulmonary Anastomoses in Postmortem Portograms. J. Schoenmackers and H. Vieten. Fortschr. a. d. Geb. d. Röntgenstrahlen **79:** 488–498, October 1953. (In German)

The authors compare, pathologically and angiographically, the conditions in which changes occur in the portal circulation with the formation of macroscopically demonstrable anastomoses. In 7 subjects the portal system was injected postmortem with barium sulfate in 10 per cent formalin solution. From these studies it is concluded that stasis in the portal vein system causes dilatation of the contributory vessels to the portal system with macroscopically visible portocaval and portopulmonary anastomoses.

Two main causes have to be distinguished in portal vein stasis: (1) cardiac congestion and (2) intrahepatic congestion due to compression of intrahepatic capillaries, as in leukemia, cholangitis, and cirrhosis. Dilated hemorrhoidal veins are found in severe acute as well as in chronic congestion. Portocaval and portopulmonary anastomoses occur only in chronic congestion and connect the portal vein system with various neighboring regions of the vena cava system and with pulmonary veins. In cases of cardiac congestion, anastomoses were found only below the diaphragm, whereas in cases of liver cirrhosis, anastomoses were also found supradiaphragmatically. Esophageal varices are only congested veins and almost never represent portocaval anastomoses.

The number and size of anastomoses should be considered in determining the advisability of a portocaval shunt operation. The diminution of blood flow following removal of the spleen may be more effective than

the increase in anastomoses produced by a shunt operation.

Ten roentgenograms. JULIUS HEYDEMANN, M.D.
Chicago, Ill.

THE BREAST

Roentgenography of Cysts of the Breast. J. Gershon-Cohen and Helen Ingleby. Surg., Gynec. & Obst. **97:** 483–489, October 1953.

Mammary cysts occur usually after the age of twenty-five, when fat begins to become a normal component of the breast, and are seen with increasing frequency toward the menopause. They vary in size from microscopic dimensions to those occupying a large segment of the breast. Only cysts exceeding 0.5 cm. in diameter can be demonstrated roentgenologically. These appear as well defined opacities, spherical or ovoid, with smooth outlines. The fatter the breast, the easier the demonstration of a cyst.

The various types of cyst are to be differentiated among themselves, as well as from other breast lesions. The most common type is the simple cyst, characteristic of mazoplasia II. Such cysts may be solitary, multiple, or conglomerate and are often surrounded by a fuzzy opaque zone. Fibroadenomas simulate cysts so closely that their differentiation may be impossible. Chronic abscess is also a source of difficulty. It should be suspected when the lesion shows indistinct margins, swollen perifocal trabeculae, and considerable increase in vascularity of the surrounding tissue. Of chief importance is the differentiation of cyst from carcinoma. Some mucoid adenocarcinomas and papillary carcinomas may appear as solitary lesions and at first glance may suggest a cyst. On palpation, however, the dimensions are found to be larger than appears on the film, which is an important point of distinction. Furthermore, retraction and thickening of the skin are indicative of a malignant character. Malignant lesions are seldom freely movable. A comet-like tail, if arising from the mass itself and not due to contiguous compression, is also suggestive of malignancy. When calcification is present, the plaque-like deposits in a cyst wall should not be confused with the minute splinters of calcium widely dispersed in and around a cancer.

[The authors have set forth the diagnostic criteria for cancer more fully in a paper appearing in Radiology **60:** 68, 1953.]

Thirteen roentgenograms.
MORTIMER R. CAMIEL, M.D.
Brooklyn, N. Y.

THE DIGESTIVE SYSTEM

Duplication of the Oesophagus. Report of a Case in an Infant. Frank Walt. South African M. J. **27:** 911–914, Oct. 10, 1953.

A three-month-old male infant was hospitalized for treatment of bronchitis, associated with fever, vomiting and diarrhea. Roentgen examination of the chest revealed an oval, homogeneous, smoothly outlined mass in the left superior and posterior mediastinum which did not pulsate or displace the esophagus or trachea. During the next six months recurrent attacks of dyspnea and bronchitis occurred, and the mass increased in size. Operation, at nine months, revealed a blue cystic mass in the mediastinum, adherent to the left upper lobe and to the esophagus. Microscopic study of the resected cyst showed layers of smooth muscle in the wall, similar to that seen in the normal esophagus. This was lined by epithelium of intestinal type in some areas and by bronchial type cells in other sections.

The author quotes Gross *et al.* (Pediatrics **9:** 449, 1952. Abst. in Radiology **60:** 304, 1953) to the effect that mediastinal cysts represent duplications of the alimentary canal and are not of bronchial origin. They arise as a diverticulum from the esophagus, although the connection with the alimentary canal is not usually demonstrated radiographically. The entity should be kept in mind in evaluating a posterior mediastinal mass in adults as well as in infants.

One roentgenogram; 2 photomicrographs.
D. D. ROSENFELD, M.D.
Fontana, Calif.

Leiomyoma of the Esophagus. Joseph R. Wilder and S. W. Moore. Arch. Surg. **67:** 595–602, October 1953.

Leiomyoma is one of a wide variety of the rare benign neoplasms which may arise from the esophagus, others including fibroma, hemangioma, adenoma, polyp, papilloma, mucocele, neurofibroma, myxofibroma, and lipoma. A review of the literature revealed a total of 67 esophageal leiomyomas reported, 43 of which were found postmortem.

The lesion may be extra- or intramucosal, and is usually asymptomatic unless sufficiently large to produce obstruction or ulceration. The x-ray picture following a barium swallow shows a non-invasive, smooth, often half-moon-shaped filling defect. Biopsy through the mucosa carries with it the risk of mediastinitis and emphysema. Enucleation without entering the mucosa can be performed with ease in the majority of cases and is the procedure of choice.

A case is reported in which the diagnosis was made preoperatively and the tumor was successfully removed.

Two roentgenograms; 1 photomicrograph; 1 drawing; 2 tables. C. M. GREENWALD, M.D.
Cleveland Clinic

Effect of the Intravenous Injection of Prostigmin and Atropine on Gastrointestinal Motility. A. Rollandi. Riv. ital. di radiol. clin. **3:** 55–69, April, May and June 1953. (In Italian)

This article is one of the many which have appeared in the European literature regarding the utilization of the pharmacodynamic effect of various drugs on the gastrointestinal tract. Most of the drugs employed increase gastric peristalsis, relax the pyloric sphincter, insure better filling of the duodenal cap, and emphasize gastrointestinal mucosal pattern. These effects facilitate the examination of pylorospastic patients and make it easier to differentiate between organic and spastic deformities. The author employs Prostigmin and atropine given intravenously at the same time and claims fewer side-effects than with other drugs.

Pharmacodynamic effects have received much attention in France and Italy, especially through the work of Porcher, Galli, LeCannet, Lura, and Agostini. Elsewhere comparatively little has been done in this field, and one wonders whether the help of drugs may not be needed more often where racial characteristics, dietary habits, or social stresses make persistent pylorospasm a real obstacle to satisfactory x-ray examination.

Thirty-three roentgenograms.
CESARE GIANTURCO, M.D.
Urbana, Ill.

Gastroduodenal Hemorrhage. Difficulties in Recognition of Lesions at Operation by Palpation and Inspection. Emanuel M. Rappaport. Ann. Int. Med. **39**: 747–756, October 1953.

Few more vexing problems confront the internist than recurrent bleeding from the upper gastrointestinal tract when repeated diagnostic studies have failed to disclose the source of hemorrhage. Most frustrating to the clinician, however, are cases in which lesions presumed to be the cause of hemorrhage are detected by roentgenogram or gastroscopy; yet at operation the surgeon reports that "after palpation and a detailed inspection of the stomach and small intestine no pathology or cause for hemorrhage was found."

This article seeks to show that palpation and inspection of the stomach or duodenum at laparotomy are not infallible, and that occasionally major pathologic lesions may be overlooked even when the mucosal surface is examined.

Five cases of recurrent bleeding from the upper gastrointestinal tract are presented. The site and presumptive cause of hemorrhage were determined by roentgenography or gastroscopy in each case preoperatively, yet at operation the surgeon was unable to corroborate the clinical diagnosis. In 1 case a hiatus hernia was repaired, in another excision was done for antral gastritis, while in 3 cases no cause for bleeding was found. Owing to recurrence of hemorrhage, a second operation was required in each case, at which time the original preoperative diagnoses were confirmed. In 4 cases a second operation would have been unnecessary had the stomach been opened for inspection at the site where pathologic changes had been noted roentgenographically or gastroscopically.

Ten roentgenograms.

STEPHEN N. TAGER, M.D.
Evansville, Ind.

Gastric Ulcer—Benign or Malignant. Preliminary Report of a Roentgenologic Study. Frank Abbot and Samuel Blank. New England J. Med. **249**: 722–726, Oct. 29, 1953.

Difficulty may arise in differentiating benign from malignant stomach ulcers. Forty cases of gastric ulcer were studied, of which 22 were proved histologically. The accuracy of radiologic diagnosis, excluding patients inadequately examined, was 94.5 per cent. The ulcers were classified as follows: (*a*) definitely benign or malignant; (*b*) probably benign or malignant; (*c*) type undetermined. The last group included cases in which a diagnosis of ulcer was made, but because of secretion, inadequate study, or obstruction, further determination was impossible.

The authors leaned heavily on spot film studies, and mucous membrane patterns. The criteria employed were as follows: (1) *Projection:* Failure of the niche to project beyond the confines of the stomach was considered to be a malignant characteristic. (2) *Collar:* Demonstration of a collar was obtained in practically all cases when compression was used. If it was even and regular it was regarded as representing edema of the ulcer crater, rather than an infiltrating lesion. (3) *Radiating folds* extending right up to the ulcer were considered to be a benign characteristic. When they were not present, the crater might be either malignant or benign. (4) *Overhanging edges* were regarded as a benign characteristic. (5) *Irregularity of the niche:* Debris or vascular structures at the base of the niche might cause irregularity, but when the irregularity was gross, it was considered a sign of malignancy. A triangular pointed niche during healing suggests benignity.

The authors believe, further, that an incisura opposite an ulcer indicates benignity. They consider local rigidity as of no diagnostic value, since it may be due either to fibrosis from chronic ulceration or to malignant infiltration. The study of peristalsis did not help in differential diagnosis. The size of the ulcer was irrelevant.

Twelve roentgenograms.

MORTIMER R. CAMIEL, M.D.
Brooklyn, N. Y.

Some Roentgenological Aspects of Peptic Ulcer. John McL. Adams. Virginia M. Monthly **80**: 379–383, July 1953.

Roentgen examination is generally accepted as the most important procedure in diagnosing and following the course of a peptic ulcer. It should reveal the location of the lesion and should aid in the differentiation of a benign from a malignant ulcer. The following differential points are suggested:

1. *Size:* The smaller ulcer is more likely to be benign.
2. *Dynamics:* Peristalsis does not usually pass through the infiltrated margin of a malignant ulcer.
3. *Mucous membrane:* The benign ulcer has normal mucous membrane up to the edge of the crater.
4. *Filling defect:* The crater of the malignant ulcer is usually confined within the boundaries of the stomach wall, while that of a benign ulcer extends through a portion or all of the wall.
5. *Location:* Greater curvature ulcers are usually malignant. Duodenal ulcers are almost never malignant.

Serial examination of the gastrointestinal tract roentgenographically is most important in following the course of a peptic ulcer. Even malignant ulceration, however, is likely to improve on an ulcer regime, although the crater seldom disappears entirely.

The author concludes that the roentgenologist need not apologize for his inability to be dogmatic with respect to the nature of a peptic ulcer in some cases. The surgeon may find it impossible to differentiate between a benign and malignant lesion even on gross examination.

Eleven roentgenograms. E. E. TENNANT, M.D.
Denver, Colo.

Radiological Criteria for the Choice of Treatment in Gastroduodenal Ulcers. Giancarlo Lischi. Omnia Therapeutica, Suppl. V, pp. 1–99. (In Italian)

This monograph poses again the question of surgical *versus* medical therapy in gastric ulcers. The radiological signs of gastric ulcerations are described in minute detail, and the radiological, clinical, and surgical findings are correlated in 19 selected cases.

According to the author, an ulcer crater should be regarded as benign when (*a*) a crater extends outside of the gastric wall; (*b*) the crater is of small size; (*c*) the crater has a small base of implantation; (*d*) there are signs of spasticity in the opposite gastric wall.

An ulcer should be regarded as malignant when (*a*) the crater is depressed and is well shown in the supine position (posterior ulcers); (*b*) the shape of the crater is irregular; (*c*) there is a meniscus sign; (*d*) the mucosal folds converge toward the crater in irregular fashion.

As far as the response to medical treatment is concerned, the author outlines five possibilities:

1. Disappearance of radiological and clinical symptoms; this should mean a benign ulcer.
2. Persistence of clinical symptoms with decrease in the size of the crater; the nature of the ulcer is questionable.
3. Persistence of the crater with marked clinical improvement; these ulcers are probably benign.
4. Persistence of radiological signs and of the clinical symptoms; these ulcers are almost certainly malignant.
5. The crater is larger after medical treatment, but the clinical symptoms have improved; these cases probably represent malignant degeneration of benign ulcers.

The author considers the cases described under 1, 2 and 3 as amenable to medical treatment. The cases described under 4 and 5 should be treated by surgery.

Twenty-two roentgenograms.

CESARE GIANTURCO, M.D.
Urbana, Ill.

Surgical Treatment of Perforated Duodenal Ulcer in the Newborn. Report of a Case. Manuel E. Lichtenstein, Lars E. Lundgoot, Anthony J. Nicosia, and Lawrence G. Khedroo. J.A.M.A. **153:** 557–560, Oct. 10, 1953.

Gastric and duodenal perforations in the newborn are usually fatal because they are not recognized and treatment is not instituted promptly. Roentgenographic demonstration of pneumoperitoneum is the most important diagnostic aid. It was the basis for recognition in the case reported here, leading to a successful operation. The literature on the subject is reviewed.

One roentgenogram; 1 drawing.

RICHARD E. BUENGER, M.D.
Chicago, Ill.

Familial Gastric Cancer. S. N. Maimon and M. M. Zinninger. Gastroenterology **25:** 139–152; October 1953.

The authors report the occurrence of gastric cancer in 4 siblings, an entire generation of a family. The father and an aunt of this group died of cancer of the stomach. The 4 case histories are presented and the literature is reviewed. One patient was still alive at the time of the report without evidence of tumor, nineteen years after surgery. The other 3 died of the disease.

X-ray studies of the stomach sixteen and eight months prior to diagnosis in one sibling were negative. In another, x-ray and gastroscopic examinations were negative eighteen months before discovery of an inoperable tumor.

The 7 children of the 4 siblings have refused prophylactic examinations.

Three roentgenograms; 6 photomicrographs.

RICHARD E. BUENGER, M.D.
Chicago, Ill.

Primary Amyloidosis with Involvement of the Stomach. Robert N. Cooley. Am. J. Roentgenol. **70:** 428–436, September 1953.

It is not uncommon to find generalized amyloid deposits in association with such chronic infections as tuberculosis, osteomyelitis, and chronic empyema. A rarer form of the disease, which is apparently unassociated with any chronic pathological process, is known as "primary amyloidosis." Lubarsch was one of the first to direct attention to the difference between these two forms. The criteria for the primary form are: (1) almost complete absence of amyloid in organs most frequently involved in typical amyloidosis, *i.e.*, the spleen, liver, and kidneys; (2) presence of amyloid in organs and parts not usually involved, as the heart, lungs, and skin; (3) occasional occurrence of tumor-like nodules of amyloidosis; (4) frequent failure of the deposits to react to the specific stains for amyloid; (5) absence of a preceding or concomitant disease with which the presence of amyloidosis may be associated.

The gastrointestinal tract has been second in frequency only to the heart as a site of primary amyloidosis. In only 7 cases, however, in addition to the one reported here, have there been definite symptoms of involvement of the stomach. On a review of these, it appears that the symptoms include hemorrhage from ulceration or erosion of areas which have been infiltrated with amyloid, epigastric pain, and symptoms of pyloric obstruction.

The most constant findings on pathological examination have been deposition of amyloid in the adventitia and ambient areas of small blood vessels of the submucosa. In addition, there has been extensive replacement of the smooth muscle in both the outer muscular wall and the muscularis mucosae. It can be readily understood how such a deposit of amyloid could interfere with normal peristalsis and motility and thus mimic a carcinoma roentgenologically. However, it is of diagnostic importance that there is no recorded instance where the stomach was the only organ affected, and usually the extragastric involvement was great enough to be detected clinically.

The author's patient was under treatment by ACTH for a generalized amyloidosis. The dosage was 200 mg. daily for fifteen days, after which time it was reduced to 160 mg. daily for a total treatment period of thirty-two days. No symptoms referable to the stomach were originally present, but after two weeks of treatment, postprandial pain appeared, associated with abdominal distention. A gastrointestinal series at this time showed deformity of the antrum of the stomach with an ulcer on the lesser curvature. Although the antrum was narrowed, peristaltic waves passed sluggishly through this area. The mucosal folds appeared normal. The deformity was thought to be due to carcinoma, although amyloid infiltration was considered. On exploration, the entire stomach had a nodular appearance, but no ulcer was found. A frozen section disclosed no evidence of tumor, and subsequent tissue studies showed amyloid disease.

Six roentgenograms; 2 photomicrographs.

BASIL DULIN, M.D.
Indiana University

Gastroduodenal Intussusception with Massive Hemorrhage. Charles G. Child, III, and Paul W. Braunstein. Surgery **34:** 754–758, October 1953.

A case of gastroduodenal intussusception with massive hemorrhage is reported. This is a rare disease which may occur spontaneously or may be associated with a pre-existing benign or malignant tumor of the stomach.

A 62-year-old male exhibited the classical symptoms of gastroduodenal intussusception, namely, severe

epigastric pain and gastrointestinal hemorrhage. Preoperative roentgenograms demonstrated duodenal enlargement, a filling defect of the duodenum, and distortion of the normal gastric contour. These findings were interpreted as indicating a tumor of the first or second part of the duodenum. At operation the duodenum was over twice the normal width and there seemed to be a tumor mass in the lumen. The stomach was completely distorted, and only the greater curvature could be identified for about 6 inches proximal to the pylorus. While the stomach was being freed, the whole mass in the duodenum suddenly reduced itself into the stomach, which assumed a normal contour. A mass could be palpated in the fundus of the stomach and on resection proved to be a leiomyoma, approximately 6 cm. in diameter. The tumor had been carried into the duodenum, intussuscepting the distal portion of the stomach with it. The patient experienced no recurrence of symptoms following surgery.

Two roentgenograms; 1 photograph; 1 photomicrograph; 1 drawing. THEODORE E. KEATS, M.D.
University of California

Mechanisms of Gas Patterns in Intestinal Obstructions. David Metheny and Vernon O. Lundmark. West. J. Surg. **61**: 566–568, October 1953.

The x-ray patterns in intestinal obstruction are dependent on both gas and fluid. It is generally considered that most of the gas is swallowed air.

The authors report 3 cases which they believe prove that, if no vomiting occurs, there will be little gas in the intestine above the obstruction. Their explanation is that gas goes against the enteric current in small bowel obstruction because, preceding vomiting, there is contracture of the stomach at the incisura dividing the stomach into two parts. When the spasm of the diaphragm and abdominal muscles occurs, the fluid and gas in the upper half are vomited, while that in the lower half is forced into the duodenum. If the patient's stomach has been resected, only regurgitation occurs; gas cannot be forced into the small bowel, and only fluid is present in the obstructed loop. Absence of vomiting and retching could easily explain the variable gas-fluid appearance on the roentgenogram.

Five roentgenograms; 1 drawing.
WINSTON C. HOLMAN, M.D.
Shreveport, La.

Pigmentation of Lips and Buccal Mucosa Associated with Intestinal Polyposis. J. Trengove Jones. South African M. J. **27**: 930–932, Oct. 17, 1953.

The author reports 4 additional cases of pigmentation of the lips and buccal mucosa occurring in association with intestinal polyposis. The polyps were pedunculated and were located in the small bowel, presenting as intussusceptions. In all the cases the polyps were discovered at operation. No account of radiological studies is given.

Four illustrations.

Front and Side-View Cholecystography, with a Study of the Angle of Vesicular Erection of the Volume of the Gall-bladder and of the Volumetric Coefficient of Evacuation. G. Albot, J. Toulet, G. F. Bonnet, and C. Moullart. Am. J. Digest. Dis. **20**: 293–301, October 1953.

The authors describe in detail a scheme for the evaluation of cholecystograms based on front- and side-view roentgenograms in decubitus before and after the fat meal. They calculate the "absolute vesicular volume" and "volumetric coefficient of evacuation" from the surface areas of the organ in the two views, the longitudinal diameters, and correction factors for photographic enlargement and distortion. With this information and the "angle of vesicular erection" obtained from the change in the vesicular vertebral angle in the side-view decubitus before and after the fat meal, they differentiate between such entities as "total vesicular stasis, cholecystatony, biliary hypotension, infundibulites, and hypercontractile gallbladders."

[In the abstracter's opinion, this is an interesting study of gallbladder anatomy and function, but the clinical significance of the findings is not presented.]

Twenty-four roentgenograms. R. F. LEWIS, M.D.
Cleveland Clinic

The Cholescintigram: A Preliminary Report. Eric T. Yuhl, Lloyd A. Stirrett, Malcolm R. Hill, Jr., and John M. Beal. Surgery **34**: 724–727, October 1953.

The cholescintigram is a new means of visualization of the gallbladder. Intravenous radioactive diiodofluorescein is used as the tracer agent, and the directional scintillation counter records the gamma radiation. This technic was developed for use in situations in which oral cholecystography is not feasible.

One millicurie of radioactive diiodofluorescein is administered intravenously. Scanning is performed at intervals of twenty minutes, one hour, and two hours after injection. In those cases where no concentration has been observed at the end of two hours, the survey has been repeated as long as four hours after injection in order to confirm this observation.

In 6 patients with normal gallbladder function, an area of concentrated radioactivity in the right upper quadrant was detected. In 4 patients with non-functioning gallbladders the cholescintigram failed to demonstrate any evidence of concentration of radioactivity in the gallbladder area. The technic has not yet been developed sufficiently to demonstrate biliary calculi.

One photograph; 4 scintigrams.
THEODORE E. KEATS, M.D.
University of California

THE MUSCULOSKELETAL SYSTEM

On the Accessory Ossicles of the Supraoccipital Bone: Some Newly Recognized Roentgen Features of the Normal Infantile Skull. John Caffey. Am. J. Roentgenol. **70**: 401–412, September 1953.

During roentgen examination of 3,800 newborn infants, shadows of single and multiple small independent bones were found in the occipital cartilage about the foramen magnum in 15 cases. These accessory ossicles have been previously recognized in a single instance, in an anatomic study of a neonatal skull (Schultz: Anat. Rec. **12**: 347, 1917–18).

The cases are reported in four groups depending on whether a single ossicle, two ossicles, three ossicles, or four ossicles were encountered. Attention is called to the fact that the development of these ossicles is independent of Kerkring's bone or process in that the latter usually disappears before birth, occupies the midsagittal plane of the head, and forms chiefly on the internal surface of the occipital bone.

These accessory ossicles are situated in the cartilaginous plate between the supraoccipital and exoccipital bones directly behind the foramen magnum. During the first weeks of life, the ossicles were always nearer to the lower edge of the supraoccipital bone than to the upper edges of the exoccipitals. Another consistent feature in their position was the tendency to protrude externally beyond the outer surface of the supraoccipital bone. All were round or oval in shape. The density was identical with that of the supraoccipital bone. The size increased with advancing age, and later the ossicles fused with the edge of the supraoccipital and with one another. In no case did fusion with the exoccipitals occur. Union of an ossicle with the supraoccipital always began on its medial edge near its upper pole. Fusion was complete at one year in all patients who were examined at that time.

The embryologic mechanism responsible for these ossicles is obscure. They are probably normal variants of developmental origin. The accessory ossicles may result from excessive segmentation of the early cartilaginous occipital arch and could be the precursors of the bony thickenings in adult skulls, on the edges of the foramen magnum, which have been called "occipital vertebra" and "proatlas" by anatomists and anthropologists.

Fourteen illustrations, including roentgenograms and tracings of roentgenograms. J. A. CAMPBELL, M.D.
Indiana University

The Diagnosis and Treatment of Giant-Cell Tumors of Bone. Edward L. Compere. J. Bone & Joint Surg. **35-A**: 822–830, October 1953.

The author calls for a distinction between true giant-cell tumor of bone and a group of benign bone tumors which may be found histologically to contain scattered multinuclear cells, as non-osteogenic fibroma, unicameral bone cyst, benign chondroblastoma, aneurysmal bone cyst, and localized manifestations of hyperparathyroidism. Distinction should be attempted on clinical, anatomic, roentgenographic, histological, and biochemical bases. It is pointed out, also, that anticipated benignity of giant-cell tumors is not always present, in that local recurrences following therapy and actual malignant manifestations may occur.

Criteria for typical giant-cell tumors are listed, several of which must be present to confirm the diagnosis. The tumors tend to occur in the ends of long bones of young adults. Pain is common, and tumefaction occurs early. Crackling of the paper-thin cortex may be elicited by palpation. Roentgenograms reveal a circumscribed, expansile osteolytic lesion with a "soap-bubble" appearance and without periosteal reaction. Microscopically the stromal cells show greater activity, with more variety of morphology, than do the stromal cells of the other benign tumors which may contain multinucleated cells. An interesting biochemical distinction is that both the giant cells and stromal cells of the giant-cell tumors contain acid phosphatase, while the stromal cells of the other tumors contain only alkaline phosphatase and never acid phosphatase.

Although he concedes that some small giant-cell tumors may be adequately treated by irradiation, the author emphatically states his preference for surgical excision. Two cases are presented in which large giant-cell tumors were treated with irradiation sufficient to produce notable soft-tissue changes. Despite this therapy, serial roentgenograms revealed progressive enlargement of the lesions. Consequently, the surgical corrections required were much more radical than would have been necessary had the lesions been excised promptly.

Eleven roentgenograms; 2 photographs; 1 photomicrograph. GEORGE E. LERNER, M.D.
Cleveland City Hospital

Primary Tumors of the Rib. Review of the Literature and Presentation of Eleven Cases Not Previously Reported. Lew A. Hochberg. Arch. Surg. **67**: 566–594, October 1953.

The author reviews a total of 205 primary rib tumors, including 11 cases of his own, and presents a classification of these lesions. The incidence was about equally divided between benign and malignant tumors, 106 being benign and 99 malignant. Eosinophilic granuloma has been omitted, being considered inflammatory rather than neoplastic. A seven-page table summarizes the cases, giving the source, clinical details, and method of treatment. Symptomatically there is a wide range, from the asymptomatic tumors found on routine chest examination to those with systemic manifestations. The most frequent complaints, both in benign and malignant rib tumors, were pain and swelling, either as individual symptoms or together.

The series included 35 cases of fibrous dysplasia, accounting for one third of all benign lesions. Next in frequency among the benign tumors were chondroma, 22 per cent, and osteochondroma, 13 per cent. X-ray findings in these two lesions are more or less the same, except that mottled areas of calcification may be present within the tumor or along the periphery in osteochondroma. Completing the benign series were xanthomatous giant-cell tumor, 9 per cent, with half the patients under seventeen years of age; hemangioma, 7.5 per cent; osteoma, 4 per cent; 2 cases each of osteofibroma, osteoid osteoma, and myxochondroma; 6 miscellaneous lesions.

Chondrosarcoma accounted for 36 per cent of all malignant tumors. Next most common was endothelioma (Ewing's tumor), seen in 24 per cent of cases, with two-thirds of the patients between ten and twenty years of age. In diminishing frequency were fibrosarcoma, 12 per cent; mixed sarcoma, 8 per cent; osteogenic sarcoma, 6 per cent; giant-cell tumor, 1 per cent. Twelve per cent of the malignant group were miscellaneous, consisting primarily of various forms of lymphosarcoma and reticulum-cell sarcoma. There were 2 plasmocytomas.

The tendency was for patients with a malignant tumor to seek medical care earlier because of the more rapid growth and severe pain. Roentgenograms were in no way conclusively characteristic pathologically. However, in a general way it can be said that a tumor confined to single rib is more likely to be benign than malignant. On rare occasion, a benign tumor has been seen to involve more than one rib.

The author feels that the likelihood of malignant transformation of a benign rib tumor is frequent enough to justify wide removal as soon as it is discovered. There is little or no justification for biopsy only, particularly with the difficulty in histological diagnosis not infrequently encountered.

Nine roentgenograms; 9 photographs of gross pathologic specimens; 2 tables.

C. M. GREENWALD, M.D.
Cleveland Clinic

Ewing's Tumor of the Talus (Astragalus) Simulating Aseptic Necrosis. Jonathan Cohen, Kenneth A. Brown, and David S. Grice. J. Bone & Joint Surg. **35-A:** 1008–1012, October 1953.

A case of Ewing's tumor simulating aseptic necrosis of the talus is presented. A three-year old boy had a painful limp of the left leg without history of trauma. The roentgen findings were consistent with aseptic necrosis of the left talus. A cast was applied, followed by a program of non-weight-bearing. Two years later, a painless, rapidly growing, firm mass appeared, involving the right zygoma and right orbit. Associated systemic symptoms were pyrexia, vomiting, and double vision. Biopsy of the mass revealed a malignant tumor. Response to irradiation was good, but two months later another large mass developed in the abdomen, and death ensued within a few weeks.

Postmortem examination revealed complete involvement of the left talus by tumor tissue with aseptic necrosis. Widespread disseminated tumor tissue of similar type was found in the retroperitoneal area, extending along the entire lumbar and thoracic spine. Metastatic tumor was found also in the sternum, ribs, pelvis, vertebrae, femora, and cranial bones. The lungs were peppered with large and small tumor nodules.

Only 3 cases of "spontaneous" aseptic necrosis of the talus were discovered in the literature, but in none were histologic studies reported. Such an unusual localization should evoke a suspicion of unusual etiology.

Five roentgenograms; 3 photographs; 1 photomicrograph.

THOMAS HWANG, M.D.
Cleveland City Hospital

Osteoid Osteoma of a Vertebral Arch. A Case Report. Stig Fagerberg and Paul Rudström. Acta radiol. **40:** 383–386, October 1953.

Twenty-one cases of osteoid osteoma of the spine were found in the literature and an additional case, the first in the Scandinavian literature, is reported.

Symptoms were tenderness over L-2, with bouts of pain, most prominent at night, in the right loin, radiating into the right groin, buttock, and thigh, and followed by aching. Roentgenograms showed destruction of the right upper part of the lamina of L-2, with progression over a period of a year. The tumor was extirpated and was found to contain irregular fimbriated osteoid formations of varying size. Cells of the osteoblastic type and osteoclastic giant cells were seen in immediate association with the osteoid tissue.

Three roentgenograms; 1 photograph; 1 photomicrograph.

JOHN F. BERRY, M.D.
Louisville General Hospital

Osteoid Osteoma in the Hand. Robert E. Carroll. J. Bone & Joint Surg. **35-A:** 888–893, October 1953.

Six cases of osteoid osteoma in the hand are presented, with emphasis on the rarity of this site of involvement. Four of the series were found to involve the second metacarpal. The remaining 2 occurred in the proximal phalanx of the index finger.

Pain and swelling with local tenderness are fairly constant clinical findings in such cases. The patients are usually young and healthy. Males and females seem to be equally affected.

The roentgenologic features are the most pertinent factor in diagnosis. The demonstration of a central nidus is considered as pathognomonic of this entity. In the small bones of the hand this may appear as a granular opacity surrounded by a perimeter of radiolucency. The nidus may be located in the medullary cavity, cortex, or periosteum. Diffuse sclerosis of the involved bone is usual. Conditions to be differentiated are sclerotic syphilitic osteitis and tuberculous osteomyelitis.

A brief review of the literature shows that only 28 cases of osteoid osteoma involving the hand, including those in the present paper, have been reported. The distribution of the sites of involvement is illustrated by a diagram.

Surgical extirpation of the nidus produces good results.

Three roentgenograms; 1 diagram.

THOMAS HWANG, M.D.
Cleveland City Hospital

Familial Metaphyseal Dysplasia. M. B. Hermel, J. Gershon-Cohen, and Donald T. Jones. Am. J. Roentgenol. **70:** 413–421, September 1953.

The authors present 2 cases of familial metaphyseal dysplasia, making a total of 4 cases documented in the literature. Bakwin and Krida in 1937 reported 2 cases, in a brother and sister (Am. J. Dis. Child **53:** 1521, 1937).

The authors' patients were also a brother and sister. The brother, aged 33, presented himself with ankle pain of several weeks duration and with a past history indicative of several pathological fractures in childhood. Physical examination revealed deformity of the long bones of the extremities and slight limitation of motion. Laboratory data were within normal limits. Roentgenograms of the entire skeleton were obtained, showing extensive changes, including failure of tubulation and increased length of the long bones, and a widening of their metaphyseal ends causing a curious wine-bottle appearance; marked thinning of the bony cortex; numerous transverse lines, particularly in the bones of the lower extremities; flaring of the anterior ends of the ribs, and failure of pneumatization of the temporal bones and the paranasal sinuses.

The patient's family were investigated and his sister was found to be afflicted with the same malady, though she was completely unaware of any bony abnormality and was without symptoms. Only roentgenograms of her lower extremities were obtained, but these showed the same remarkable changes that were present in her brother.

Twenty-three roentgenograms.

PAUL HARDING, M.D.
Indiana University

Etiology of Infantile Cortical Hyperostosis (Caffey's Syndrome). K. Veller and A. Laur. Fortschr. a. d. Geb. d. Röntgenstrahlen **79:** 446–452, October 1953. (In German)

The authors review the symptomatology of Caffey's syndrome. The etiology is not clear. The prognosis is good, with healing in several weeks or months. Occasionally residual changes, such as a widened shaft and slight bowing, are observed.

Two cases of Caffey's syndrome are reported in a father (in 1929) and son (in 1952). In view of the occurrence in two generations, the authors suggest the possibility of an hereditary factor together with a still unknown *Noxe* (specific? or non-specific?) as the etiologic factor for the syndrome. An abnormal blood

supply may cause anoxemia, which in turn stimulates the periosteum to proliferation.

Nine roentgenograms.

JULIUS HEYDEMANN, M.D.
Chicago, Ill.

Adult Periosteal Tuberculosis. Case Report. Herbert E. Hipps. South. M. J. **46**: 953–955, October 1953.

A case of adult periosteal tuberculosis is reported because of its extreme rarity and diagnostic difficulty.

The patient, a 42-year-old white female, complained of pain in the right ankle of four years duration. The ankle was swollen, and thickening of the soft tissue was present behind and below the lateral malleolus. Roentgenograms showed irregular nodular and spicular periosteal thickening of the margin of the medial malleolus. There was a small zone of destruction of the tip of the lateral malleolus. Films of the shoulders, elbows, hips, pelvis, chest, and spine were normal.

At operation, thickening of the tendon sheaths and rice bodies were found. The pathological report indicated chronic tuberculous inflammation of the tendon sheath. Following excision of the inflammatory mass, the patient had no further difficulty.

One roentgenogram. THEODORE E. KEATS, M.D.
University of California

Aseptic Necrosis of Bone in Caucasians with Chronic Hemolytic Anaemia Due to Combined Sickling and Thalassemia Traits. Rudolph S. Reich and Norman J. Rosenberg. J. Bone & Joint Surg. **35-A**: 894–904, October 1953.

The authors observed 3 patients, all of Sicilian ancestry, with chronic hemolytic anemia due to the combined presence of sickle-cell and Cooley's traits. In 2 of these there was associated aseptic necrosis of bone. In children such bony changes are indistinguishable, clinically and roentgenographically, from Perthes' disease. In adults they must be differentiated from bone changes incident to Gaucher's disease, metastatic neoplasms, caisson disease, Paget's disease, and fracture or dislocation of the hip.

One of the authors' patients was a woman of twenty-nine with aseptic necrosis of the heads of both the humeri and femora. A sister of twenty-seven, who also exhibited sickle-cell and Cooley's traits, had no bone changes. The third patient was a boy of nine, with aseptic necrosis confined to the head of the left femur. An additional case in a Negro is reported.

Genetically these patients do not have a true sickle-cell anemia but clinically and hematologically they meet all the criteria of the disease except that the anemia is less severe.

After a review of the literature and consideration of the pathophysiology of the bone changes in sickle-cell anemia and Cooley's anemia, the authors are inclined to believe that the occurrence of aseptic necrosis in patients with chronic hemolytic anemia due to combined sickling and thalassemia traits has a similar etiology. They suggest that if patients with sickle-cell anemia lived longer, they probably would show more bone changes. Patients with the combined traits appear to have a milder anemia and greater longevity than patients who are homozygous for either trait.

Nine roentgenograms; 1 table.

BENJAMIN KAUFMAN, M.D.
Cleveland City Hospital

Sickle Cell Anemia and Salmonella Osteomyelitis. William Stanley Smith. Ohio State M. J. **49**: 692–695, August 1953.

Three cases of symptomatic sickle-cell anemia are discussed in which there also existed a hematogenous osteomyelitis caused by *Salmonella* or a *Salmonella*-like organism. At least 5 other examples of this combination are known to the author. All 3 of his patients were Negroes. The osteomyelitis in 1 case involved symmetrically the long bones of both upper and lower extremities; in another, only the right humerus was involved; in the third, both humeri and femora showed changes. Two of the 3 patients had draining sinuses.

The radiographic findings consisted of destructive changes in the shafts, usually sparing the metaphyses. Many bones showed secondary sclerosis, periosteal proliferation, and sequestration. In 1 case there were cyst-like rarefactions in the medullary cavities of the humeri, and expansion caused by periosteal thickening. Neither sickle-cell anemia nor *Salmonella* infection commonly produces bony changes. However, patients with sicklemia are susceptible to infection. The differentiation between septic infection occurring on the basis of sickle-cell anemia alone and bacterial osteomyelitis is difficult, and radiologic criteria are not helpful. Furthermore, when they do occur, the bone changes in sickle-cell anemia are similar to those occurring in early hematogenous osteomyelitis. The mechanism in both involves infarction of bone. For this reason, in patients with sickle-cell anemia, co-existing bone infection may be overlooked. Bacteriologic studies should be helpful.

Seven roentgenograms. D. D. ROSENFELD, M.D.
Fontana, Calif.

Successful Non-Surgical Treatment of Acute Osteomyelitis of the Ulna. A Case Report. Joseph B. Herman. South African M. J. **27**: 933–934, Oct. 17, 1953.

The author reports a case of acute osteomyelitis of the ulna in a child of twenty months successfully treated with antibiotics (Aureomycin, penicillin, streptomycin). Serial films are reproduced, showing negative findings on the sixth day, extensive bone destruction on the sixteenth day, continued destruction with involucrum formation at thirty-nine days, dense thickening but practically complete healing at one-hundred thirty-five days, and considerable modeling approaching normal contour by two-hundred ninety days. It is important to remember that the x-ray findings lag far behind the clinical manifestations of healing in antibiotic therapy of this type of acute osteomyelitis.

Six roentgenograms. ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Tabetic Spinal Arthropathy. H. W. Holland. Proc. Roy. Soc. Med. **46**: 747–752, September 1953.

Arthropathy as a complication of tabes was first described by Charcot in 1868. Although this condition is not entirely symptomless, the radiological picture may indicate very much more severe changes than the symptoms would suggest. The author reports 5 cases and states that the radiological features are quite distinctive. The films showed (1) progressive enlargement of vertebrae resulting in massive appearance of the spine, (2) bone destruction and new bone formation, (3) beaky osteophyte formation, (4) vertebral wedging, (5) sclero-

sis and subluxation, (6) loss of disk space, and (7) suggestion of loose bone.

In the differential diagnosis, the following conditions should be considered: (1) hypertrophic osteoarthritis, (2) tuberculous disease of the spine, (3) chronic low-grade osteomyelitis, (4) Paget's disease.

Five roentgenograms; 3 photographs.

DANIEL WILNER, M.D.
Atlantic City, N. J.

Abnormal Position of the Presacral Vertebra and Its Significance for the Diagnosis of Prolapse of an Intervertebral Disk. K. Albrecht. Fortschr. a. d. Geb. d. Röntgenstrahlen **79:** 461–468, October 1953. (In German)

The author surveyed the roentgenograms of 200 patients who were operated upon with the clinical diagnosis of prolapse of an intervertebral disk. The roentgenograms of 33 patients in whom the findings were not typical of disk prolapse were especially carefully studied for developmental variations in the lumbosacral area. The angle between the lumbar spine and sacrum was studied in upright films, together with the inclination between the 4th and 5th lumbar vertebrae.

In 60 per cent of patients with so-called assimilation disturbances, surgery proved that the symptoms were not due to a protruding disk. Angle measurements point to a relationship between position of the presacral vertebra and pain. A considerable tilt of the presacral vertebra usually excludes disk protrusion. Pain may be due to root compression in the intervertebral foramen or to abnormal pressure on the presacral disk.

Six drawings. JULIUS HEYDEMANN, M.D.
Chicago, Ill.

Asymptomatic Fractures in Osteoporotic Spines of the Aged. J. Gershon-Cohen, A. M. Rechtman, Harold Schraer, and Nathan Blumberg. J.A.M.A. **153:** 625–627, Oct. 17, 1953.

Studies of the spines of 136 residents of the Home for the Jewish Aged, in Philadelphia, between the ages of sixty-three and ninety-four years, revealed fractures in 25 per cent. Eleven of 54 men and 24 of 82 women had fractures without clinical evidence of disability and without a previous history of fracture. All spines having fractures were osteoporotic and many showed cod-fish deformities of the vertebral bodies. Contour irregularities of the intervertebral spaces adjoining the fractures were uniformly observed. Hypertrophic osteoarthritis or degenerative changes were present in all members of the group. These changes were most marked in the region of the fracture. Kyphosis was common but rarely localized to the fracture site.

The twelfth thoracic and first lumbar vertebrae were most frequently fractured. Multiple fractures, when present, were confined to the thoracic spine or to the combined thoraco-lumbar area. Most fractures involved the upper anterior portion of the vertebral body. All fractures healed well without special treatment.

The retardation of osteoblastic activity in the bones of aged people is largely responsible for these osteoporotic fractures. Collateral studies in this group indicated that decreased blood supply to the vertebrae because of arteriosclerosis is a significant factor in retarding osteoblastic activity.

Four roentgenograms; 2 tables.

RICHARD F. MCCLURE, M.D.
Palos Verdes Estates, Calif.

Arteriography of the Hip Joint for Predicting End Results in Intracapsular and Intertrochanteric Fractures of the Femur. Frederick W. Rook. Am. J. Surg. **86:** 404–409, October 1953.

The author dissected four hips in cadavers and exposed the blood supply to the joint. Several diagrams of the findings were made in varying projections, and from these a composite diagram was constructed representing an anteroposterior view showing the vessels as they might appear radiographically if they were radiopaque. By injection of the common femoral artery in postmortem specimens and in clinical cases an arteriogram of the vascular pattern was obtained. This compared surprisingly well with the composite dissection diagram. A second composite diagram was then made, including a few slight changes which became evident from the arteriographic study. This second composite diagram was used as the standard normal arteriogram of the hip joint. It was felt that on this basis arteriographic changes secondary to fractures could be evaluated.

Clinical arteriograms were obtained postoperatively by the rapid injection of 20 c.c. of 35 per cent Diodrast into the common femoral artery, just below the level of the inguinal ligament. A tourniquet constricted the mid-thigh during injection. No complications were evident during or after the procedure. Visualization of all vessels present was obtained except for the obturator, nutrient and gluteal vessels and the vessels of the ligamenta teres.

By this means, the author studied 9 patients with intracapsular and 3 patients with intertrochanteric fractures of the femur. Two of the 12 patients were discarded from the study because of the poor quality of the arteriograms obtained. Two patients had excellent blood supply and the fractures showed very early union. Four patients had a definitely inadequate blood supply as shown by arteriography. One of these showed early evidence of non-union; 1 went on to absorption and aseptic necrosis; 1 displayed union at sixteen months; and in the other the neck of the femur was shortened by absorption, but union occurred. Three patients had a limited blood supply as indicated by arteriography. One of these 3 showed a good supply, although inadequacies existed, and there was early union of the fracture; 1 showed a fair supply only, but there was early union of the fracture, contrary to results expected; 1 showed a limited but apparently adequate blood supply, and healing was slow, with the fracture line still visible at eight months. The remaining patient had a moderate to poor blood supply. In this case there was absorption of the head of the femur but union began at eight months.

The series is admittedly small, but it permits the conclusion that the use of this procedure is easy, safe, and in no way detrimental to the patient. Results tend to indicate a correlation between changes in the arteriograms secondary to fracture and subsequent healing.

Four arteriograms; 1 diagrammatic drawing.

E. E. TENNANT, M.D.
Denver, Colo.

Luxatio Coxae Congenita: A Follow-up Study of Four Hundred and Six Cases of Closed Reduction. Eivind Platou. J. Bone & Joint Surg. **35-A:** 843–866, October 1953.

The author reports a series of 277 cases of congenital hip dislocation treated by closed reduction during

1934–47, with a follow-up evaluation period of from three to sixteen years. Bilateral involvement in 129 cases brought the total number of dislocated hips to 406. It is pointed out that, although much disagreement exists among various authorities as to the best method of treatment, the one point upon which there is consistent agreement is that reduction should be performed no later than the age of two years and preferably at about the age of one year.

The method of treatment by closed reduction is described in fairly complete outline. In reporting his results, the author states that these cannot be taken as a final overall picture, as none of the patients is as yet more than twenty years old, and even after that age regressive changes may take place in the treated hips. Therefore, this series will need re-evaluation after another ten-year period at least.

The best late results were obtained in those children in whom reduction was performed sometime between infancy and two years of age; whether the involvement in this group was unilateral or bilateral did not appreciably alter the results. Clinical results were usually better than the results as indicated roentgenographically. The latter were "good" in 100 unilateral and 108 bilateral dislocations.

The factors taken into consideration regarding the prognosis were (1) age at time of reduction, (2) x-ray appearance of the bone nucleus of the femoral head, (3) the acetabular angle, (4) the degree of displacement as seen on the roentgenogram, and (5) injury to the femoral head during reduction. Of these five factors, the most significant appear to be the degree of trauma and the age of the patient at the time of reduction; the degree of displacement and condition of the femoral head bone nucleus had some moderate prognostic value; the acetabular angle was of only slight significance.

The author concludes that his overall results with closed reduction are equally satisfactory as results reported elsewhere in the literature. In view of the relation of trauma of reduction to the end-results, he believes that, when closed reduction is not obtained after two or three attempts by an experienced operator, open reduction should be performed without further delay.

Eighteen roentgenograms; 1 photograph; 22 tables.

CARLYNE A. NEWMAN, M.D.
Cleveland City Hospital

A Simplified Lateral-View Cassette Holder for Use During Hip-Nailing. B. R. Wiltberger. J. Bone & Joint Surg. **35-A:** 1018–1019, October 1953.

This report describes the construction and use of a simple inexpensive cassette holder for the lateral exposure required in the hip-nailing procedure. It consists of two metal C clamps welded together at right angles. A piece of round metal, ⅜ inch in thickness, is welded to the lower jaw of the cassette-holding clamp to compensate for the offset caused by the depressed posterior aspect of most cassettes.

Two photographs. G. ROBERT HANSON, M.D.
Cleveland City Hospital

Growth and Metabolism in Normal and Thyroid-Ablated Infant Rhesus Monkeys (Macaca mulatta). Lee B. Lusted, Donald E. Pickering, Delbert Fisher, and Francis Scott Smyth. Am. J. Dis. Child. **86:** 426–435, October 1953.

Complete destruction of the thyroid glands of four infant monkeys was brought about by 1.5 mc of I^{131}, and the effects of thyroid ablation were studied over a four-month period. Subsequently the effects of replacement therapy with crystalline *l*-thyroxine were evaluated over a similar period. Thirty-day total-body roentgenograms of the experimental animals were obtained and compared with controls.

In the thyroid-ablated animals gain in weight ceased, the skin became thickened, the hair coarse and dull, and the abdomen protuberant, with umbilical hernia. Tooth eruption ceased and the tongue showed macroglossia. Marked retardation in the growth of the long bones as well as delay in appearance of secondary ossification centers occurred uniformly. The skull shared in the growth retardation and showed abnormally wide sutures, overriding of the basiocciput and enlargement of the sella turcica.

Administration of *l*-thyroxine in adequate dosage (20 γ per kg. per day) resulted in a return of the metabolism and skeletal development to normal.

Five roentgenograms; 2 photographs; 3 graphs; 3 tables. ZAC F. ENDRESS, M.D.
Pontiac, Mich.

OBSTETRICS AND GYNECOLOGY

The Treatment of Infertility in Private Practice with Emphasis on Hysterosalpingography. John H. E. Woltz, W. Z. Bradford, Wallace B. Bradford, and Charles W. Brown. Am. J. Obst. & Gynec. **66:** 801–806, October 1953.

In a series of 100 consecutive private patients (white) in whom hysterosalpingography was done for infertility, 56 pregnancies resulted. The authors believe that hysterosalpingography is the best method of determining the patency of the tubes and consider it more reliable than the Rubin test. There were 65 patients with bilateral patency of the tubes, 19 with unilateral patency, 8 with bilateral obstruction, and 8 in whom hysterosalpingography revealed other pathological conditions—infantile uterus, bicornate uterus, fibroids (submucous), and hydrosalpinx. Thirty-eight pelvic pathological lesions were noted on physical examination in the group.

The authors believe that the combination of hysterosalpingography, hormone therapy, correction of gynecological lesions, and artificial insemination in selected cases, offers a realistic approach to the treatment of the infertile patient in private practice.

Twelve tables. ROBERT EGAN, M.D.
Jefferson Hospital, Philadelphia.

The Importance of X-Ray Visualization of the Placenta. Harry O. Maryan and Otto Wallis. S. Clin. North America **33:** 1457–1472, October 1953.

The history of x-ray visualization of the placenta is reviewed at length. The authors use an aluminum wedge-shaped filter, graduated from 1.0 mm. on the pelvic side to 20 mm. on the abdominal side. A single lateral film including the abdomen and pelvis is taken routinely. The placenta was visualized on the posterior uterine wall in 47 per cent and on the anterior uterine wall in 43 per cent of 1,083 cases examined in this manner. If the placenta is not visualized in the lateral projection, it is deduced that it is in the lower uterine segment.

Of 6 cases of placenta praevia diagnosed clinically, 4 were demonstrated roentgenographically. One was too

early (172 days) for visualization of the placenta. In the other the placenta was not outlined, but it was thought that the fetal head was in normal relation to the bladder.

In 9 cases of placenta praevia marginalis and in 3 cases of placenta praevia lateralis, the x-ray findings were corroborated by cesarean section.

Eight roentgenograms; 2 photographs.

RICHARD E. BUENGER, M.D.
Chicago, Ill.

THE GENITOURINARY SYSTEM

Aortography and Retroperitoneal Oxygen in Urologic Diagnosis: A Comparison of Translumbar and Percutaneous Femoral Methods of Aortography. Robert C. Walter and Willard E. Goodwin. J. Urol. **70:** 526–537, September 1953.

In a previous publication (Goodwin *et al.:* Ann. Surg. **132:** 944, 1950. Abst. in Radiology **57:** 616, 1951) it was concluded that translumbar needle aortography was simpler and less hazardous than retrograde catheterization of the aorta through surgical exposure of the femoral artery. Peirces' subsequent development of the simpler technic of percutaneous catheterization of the femoral artery (Surg., Gynec. & Obst. **93:** 56, 1951. Abst. in Radiology **58:** 899, 1952) has led to this further comparative study of the two methods.

Translumbar aortic puncture has been performed by the technic originally described by Dos Santos, under local anesthesia. The crampy abdominal pain which accompanies the injection of a contrast medium can be reduced by the intra-aortic injection of 5 c.c. of 1 per cent procaine. A steel 17-gauge needle 7 inches long, with the inside diameter of a 16-gauge needle, is used. A modified Huber point provides some directional control of the flow of the contrast medium. A needle stop fixes the needle in position once it has been properly placed.

For percutaneous femoral artery catheterization Peirce's method was employed, with either general or local anesthesia. For arterial puncture a 12-gauge Robb cannula is used. Polyethylene tubing is introduced into the aorta and the cannula is removed.

The authors use a test injection of 3–4 c.c. of contrast medium, followed immediately by roentgen exposure. This determines if the translumbar needle or the polyethylene tubing is in the correct position and, if not, how much correction needs to be made. After the test injection, 10 to 12 c.c. of the medium is rapidly injected for the aortogram. This amount is repeated if necessary. Either 75 per cent Neo-iopax or 70 per cent Urokon is used, and single or multiple x-ray exposures are made with the Sanchez-Perez seriograph. Multiple exposures greatly enhance the diagnostic acuity of the procedure.

Retroperitoneal oxygen insufflation as devised by Ruiz Rivas was used in some cases in conjunction with aortography for better visualization of retroperitoneal structures. Under local anesthesia, with the presacral routine, about 500 to 800 c.c. of oxygen is injected by hand with little discomfort to the patient.

The authors employed both translumbar and percutaneous femoral aortography in one series of cases and only one of the two procedures in another group, although they do not give the number of cases in either series. They feel that the translumbar method is quicker and easier and usually gives better roentgenograms, but that the femoral puncture method has the distinct advantage of mobility of the tubing and thus the selection of the site of injection of the contrast medium. Indications for the translumbar method are (1) most cases of simple renal arteriography, and (2) peripheral vascular disease or obliterative disease of the aorta; contraindications are (1) lumbar aortic aneurysm, (2) severe lumbar scoliosis, (3) inflammatory disease of the lumbar spine or retroperitoneal area. The percutaneous femoral method is indicated (1) in most children, (2) where movement of patient is desired, (3) in patients in casts which prevent the prone position, (4) for visualization of adrenals, and (5) for aortic aneurysm; contraindications are (1) peripheral vascular disease, (2) extreme obesity, and (3) local lesions of inguinal region.

No serious complications were encountered with the procedures employed.

Fourteen roentgenograms; 2 photographs; drawings illustrating the technic.

JAMES A. LYON, JR., M.D.
University of Pennsylvania

Delayed Cystograms. Charles Montgomery Stewart. J. Urol. **70:** 588–593, October 1953.

Delayed cystography is performed by instilling a 15 to 20 per cent solution of contrast medium into the bladder until distention causes the piston of the syringe to be forced back slowly. The usual requirements are 1 to 4 ounces for children and 4 to 8 ounces for adults. Urokon is believed to cause the least chemical urgency when retained in the bladder. Films are made immediately and at fifteen- to thirty-minute intervals for two to three hours. In this manner ureteral reflux may be demonstrated. It may occur at one interval and disappear at a later interval. Reflux does not necessarily occur in patients with widely patent orifices, and may occur through some ureteral orifices which are competent when seen through the cystoscope.

The author raises many interesting questions about the physiology of the vesico-ureteral junction and hopes that further studies with this method will answer them.

Eight roentgenograms.

RICHARD E. BUENGER, M.D.
Chicago, Ill.

Reactions to Urographic Agents With and Without Antihistamines. Thomas D. Moore and Nelson Sanders. J. Urol. **70:** 538–544, September 1953.

The authors investigated the effects of antihistamines given intravenously, simultaneously with the contrast medium, in 510 patients undergoing intravenous urography. Four groups received, respectively, the following solutions: (*a*) 30 c.c. Diodrast 35 per cent with 20 mg. Benadryl; (*b*) 30 c.c. Diodrast 35 per cent with 6 mg. Thenfadil; (*c*) 30 c.c. Diodrast 35 per cent (the usual diethanolamine salt), as a control; (*d*) 30 c.c. of 35 per cent methyl glucamine salt of Diodrast. A fifth solution consisting of the sodium salt of Diodrast was used in only a few patients.

The differences in the reactions to the various solutions was not striking. The methyl glucamine salt appeared to be somewhat better tolerated than the diethanolamine salt. The use of a potent antihistamine with Diodrast seemed to offer some advantage from the standpoint of reduction of side effects.

Since both a change of the salt of Diodrast and addition of an antihistamine to Diodrast 35 per cent solu-

tion appeared to decrease the incidence of reactions, the next step seems clear. A combination of the methyl glucamine salt of 3,5-diiodo-4-pyridone-N-acetic acid and some potent antihistamine such as Thenfadil should be studied.

Four tables.

HAROLD L. ATKINS, M.D.
University of Pennsylvania

The Diagnosis of Urological Trauma in the Presence of Other Injuries. Lazarus A. Orkin. S. Clin. North America **33**: 1473–1495, October 1953.

The author introduces his paper with an analysis of 37 instances of renal trauma seen over a ten-year period, all but 9 of which were associated with other injuries. He found no correlation between the intensity of trauma, the clinical signs and symptoms, and the gravity of the urinary tract injury.

The urologist's problem is to determine not so much the presence of urological trauma as to discover its exact extent, *i.e.*, whether or not urinary extravasation, which is indicative of rupture, exists. There are no pathognomonic signs or symptoms prior to the onset of obvious extravasation. Yet to await the classical evidences of extravasation is to court a possible fatality. It has been found that a delay of operation from twelve to twenty-four hours after injury quadruples the mortality.

In view of these observations, a routine is presented for the diagnosis of urological injuries occurring simultaneously with other trauma. The basic concept of this routine is a thorough urological roentgen examination to demonstrate rupture of the urinary tract before the onset of obvious extravasation. Bedside examinations with a portable x-ray unit are performed on all patients whose injuries prevent transfer to the x-ray department. A cassette tunnel is used to hold a grid-front cassette. In general, films thus obtained have proved to be diagnostic and immeasurably valuable, sometimes life-saving.

A plain film of the abdomen is made to demonstrate fractures of the last two ribs, lumbar transverse processes, or pelvis. With any of these injuries the integrity of the genitourinary tract must be established. With pelvic fracture a rupture of the lower urinary tract is considered present until proved otherwise. The plain film may also disclose a grossly enlarged kidney and establish the presence of two kidneys, but otherwise it is likely to be disappointing.

Excretory urography is the next step in roentgen study, including sixty- and ninety-minute films. It was found to be diagnostic in 27 out of 37 bedside examinations on seriously ill patients, including all of 9 patients who were in shock, with blood pressures between 58 and 62 mm. Hg systolic.

If the cystogram obtained by the excretory route is in any degree unsatisfactory, retrograde cystography with at least 350 c.c. of 6 per cent contrast material is done. This was found to be an infallible method for diagnosing rupture of the lower urinary tract. Either intra- or extraperitoneal extravasation may be seen. With the latter a vertically elongated "tear-drop" bladder is often seen and is difficult to distinguish from the same deformity produced by extravesical hemorrhage. One must therefore demonstrate contrast material outside of the bladder for confirmation. An emptying film of the bladder will often disclose posterior extravasation obscured by the filled bladder.

Air cystograms are mentioned only to be condemned; 34 of 781 physicians using this method have reported air embolization and death.

Urethrocystography with 20 c.c. of a 6 per cent solution of contrast material is performed to demonstrate posterior urethral tears.

Cystoscopy with retrograde pyelography is rarely justified in seriously ill patients with associated lesions. Otherwise, it is definitely useful in the evaluation of upper urinary tract injuries.

Nineteen roentgenograms; 3 tables.

RICHARD E. BUENGER, M.D.
Chicago, Ill.

Nephrocolonic Fistula. A Dual Case Study. Milo Ellik and John Getz. J. Urol. **70**: 364–372, September 1953.

Nephrocolonic fistulas are usually due to perinephric infection as a result of an eroding calculus, perinephritis, or tuberculosis. Neoplastic disease has never been mentioned as a cause. Only 56 cases of fistulas between the kidney and the colon have been recorded in the literature. Due to the rarity of this entity the authors were prompted to report 2 additional cases.

Previous studies have indicated the presence of primary disease within the kidney, with subsequent erosion of a calyx and the production of a perirenal abscess with ultimate rupture into the colon. Anatomically one-third of the anterior renal surface lies adjacent to the colon. In a typical case a perinephric abscess will suddenly vanish, followed shortly by the appearance of blood, pus, and urine in the stools. There may be symptoms of renal colic, psoas muscle irritation, frequency, dysuria, pyuria, and hematuria. Antibiotics and chemotherapy often alter the clinical picture.

The diagnosis usually depends upon actual demonstration of the fistulous tract by means of a retrograde pyelogram. Excretory urography and the opaque enema are not reliable diagnostic aids.

Treatment often requires drainage of the perinephric infection and eventually removal of the involved kidney.

The first of the authors' 2 patients was a 62-year-old woman whose clinical course paralleled closely the classical picture of an eroding renal calculus. A roentgenogram of the abdomen showed calculi in the superior and inferior calyces of the left kidney. Excretory urography was unsatisfactory. Retrograde pyelography demonstrated a renocolic fistula at the upper pole of the left kidney with drainage into the colon and a stricture at the right ureteropelvic junction. One month after drainage of the left perirenal space, aortography demonstrated a normal right kidney, but a scanty blood supply on the left. Following release of adhesive bands at the right ureteropelvic juncture, the left kidney was removed and the remnants of the fistulous tract were demonstrated on cut section.

The second patient was a 28-year-old female with gross hematuria following severe trauma to the left flank. Excretory and retrograde urography indicated injury to the lower pole of the left kidney. Twenty-three days after the initial hematuria, severe watery diarrhea developed, accompanied by fever and toxicity. Urinary dyes given by mouth were excreted in large amounts in the stools. Retrograde pyelography and enemas did not reveal a fistulous tract. After frequent intermittent attacks of diarrhea during the next six months, a left nephrectomy was done. No fistula was demonstrated, but adhesions were found at the

lower pole of the kidney intimately associated with the adjacent colon.

This latter case is of interest as demonstrating that, in the absence of radiographic visualization of a nephrocolonic fistula, administration of urinary dyes and their subsequent appearance in the stools is an indication of a renocolonic communication. The other case indicates that aortography can be of definite value in the prognosis and management of patients with nephrocolonic fistulas.

Six roentgenograms; 1 photograph.

DAVID J. STEPHENSON, M.D.
University of Pennsylvania

Extravesical Ureteral Ectopia. William L. Huffman, Lester Persky, and James J. Joelson. J. Pediat. **43:** 407–412, October 1953.

Ectopic ureter opening extravesically is a rare anomaly, observed more commonly in females than males. In the female the ectopic opening may occur in the following locations, listed in order of frequency: vestibule of vagina, urethra, vagina, cervix or uterine cavity, and Gartner's duct. In the male the opening may be into the posterior urethra, seminal vesicle, prostatic utricle, ejaculatory duct, or vas deferens. Rarely, in either sex, the communication may be with the rectum. Commonly, upon investigating the upper urinary tract, reduplication of the pelvis and ureters is found, with the ectopic ureter most frequently being from the upper pole. However, both ureters of a duplication have entered ectopically, as have ureters from normal kidneys, solitary kidneys, and kidneys which were the site of other types of anomalous development.

The symptoms of extravesical ureteral ectopia differ with the sex. Among females the most frequent complaint is leakage of urine independent of normal micturition. When infection is present, the lesion may be manifested by a purulent discharge, or chills, fever, and flank pain. The condition in males has been diagnosed less frequently, because the ectopic site is always above the external sphincter of the urethra; incontinence, therefore, is not a part of the symptomatology.

The reduplication of the pelvis and ureter with or without dilatation of the upper segment may be demonstrated by intravenous urography. If marked destruction of the kidney subsequent to obstruction has taken place, there may be failure to visualize the upper portion of a double kidney or of the entire kidney if duplication is not present. When the lesion is suspected, an attempt at identification and catheterization of the ectopic orifice should be made.

The authors report 9 cases of this condition, of which 7 were in females. The females all had reduplications on the involved side; in 3 there was bilateral reduplication of the urinary tract. In neither of the males were the kidneys duplicated.

Six roentgenograms.

HOWARD L. STEINBACH, M.D.
University of California

Tumors of the Ureter. William J. Baker and Edwin C. Graf. J. Urol. **70:** 390–409, September 1953.

The authors report 17 cases of tumor of the ureter from St. Luke's Hospital and Cook County Hospital, Chicago, Ill. Since 1 of these was previously reported and 1 case of metastatic lymphosarcoma is included, 15 new primary cases are added to the 200 previously published. Of the authors' 16 primary tumors, 11 occurred in males and 11 were found in the left ureter. Three were benign mucosal polyps, all involving the middle third of the ureter and all in patients in the fourth decade. Of the malignant tumors 9 were papillary and 4 were squamous-cell carcinomas. Most of these occurred in the lower end of the ureter; 4 of them involved the entire ureter. Five patients had a previous history of bladder tumors, and in 4 there was either tumor in the ureter at the time of a previous nephrectomy or a tumor later developed in the ureteral stump.

The symptomatic triad diagnostic of ureteral tumor includes hematuria, pain, and a mass due to a large hydronephrotic kidney above the obstructed ureter. Plain roentgen studies may show bony metastases, the large kidney mass, and calcified areas in the ureteral tumor, which in one of the authors' cases simulated a ureteral calculus. Retrograde roentgen studies will usually reveal the filling defects and obstruction in the ureter.

The treatment recommended is complete nephroureterectomy, preferably in one stage. Roentgen and radium therapy may be used for metastatic pain, but have not proved too successful in the authors' hands.

The prognosis of ureteral cancer is generally poor. The authors point out that this may be due to the relatively thin wall of the ureter, which allows the tumor to spread very early and rapidly. Ureteral tumors do metastasize much earlier than histologically similar tumors in the bladder. Careful urological follow-up for patients with a history of bladder tumor is recommended.

Twenty-two figures including 11 roentgenograms; 1 table.

W. H. NEIL, M.D.
University of Pennsylvania

MISCELLANEOUS

Radiologic Aspects of "Collagen" Diseases. L. H. Garland and M. A. Sisson. California Med. **79:** 284–292, October 1953. See also Am. J. Roentgenol. **71:** 581–598, April 1954.

This paper represents a review of the authors' observations on 86 patients with a hospital diagnosis of "collagen" disease (diseases characterized by generalized or disseminated alterations of the connective tissue, especially its extracellular collagenous components: predominantly, periarteritis nodosa, disseminated lupus erythematosus, dermatomyositis, scleroderma, rheumatic fever, and rheumatoid arthritis). The localization of these changes and the response of the adjacent tissues vary in the above diseases and thereby constitute a means for partial differentiation.

Periarteritis Nodosa: Radiologic findings in periarteritis nodosa are variable as to presence, degree, and location, depending upon the system and arteries involved. The most frequently observed findings (in 20 of 28 cases seen) were in the chest. They included cardiac enlargement and/or pericardial effusion; pulmonary changes ranging from nodular parenchymal densities to diffuse patchy pulmonary edema or massive symmetrical or non-symmetrical edema, and occasionally accentuated hilar and basal markings; pleural effusions secondary to pneumonitis or pulmonary infarction. Roentgen abdominal findings are uncommon. There may be mild paralytic ileus or, rarely, evidence of perforated ulcer, intestinal infarction, or pancreatic necrosis.

Disseminated Lupus Erythematosus: Pathologically the essential lesions in disseminated lupus erythematosus involve the smaller arteries and arterioles. Polyserositis is common, with pericardial lesions the most frequent. Radiologic findings are most commonly seen in the urinary and respiratory systems. Unusually large kidneys in a patient with hypertension suggest this disease. Pulmonary involvement is frequent and atypical. Twenty-one of 32 cases showed intrathoracic findings: cardiac enlargement in 5, pericardial effusion in 5, pleural effusion in 13, pulmonary changes in 10 (varying from accentuated basal pulmonary markings to nodular or patchy densities and/or diffuse edematous changes).

Dermatomyositis: But one case of dermatomyositis is included in this series. No significant radiologic findings were observed.

Scleroderma: Twenty-five cases of scleroderma showed diverse roentgen findings. The authors report these findings and summarize those described in the literature. In the *gastrointestinal tract* there are reduced peristalsis, variable degrees of dilatation in the esophagus and small bowel, occasional segmental narrowing in the distal esophagus and colon. It is felt that the small bowel involvement often starts in the distal duodenum and the dilatation then progresses distally. In the *lungs* there may be diffuse or localized fibrosis, nodulation, basal subpleural cystic changes, or calcinosis. *Fingers* show absorption of the distal phalanges in advanced cases. Occasionally increased phalangeal density is observed. The distal and middle phalanges may show synostosis. In the *soft tissues* there is calcinosis in pressure areas, usually in association with cutaneous sclerosis.

Acute Rheumatic Fever: Roentgen examination may show pleural or pericardial effusion and in fulminating cases a non-specific pneumonitis. Para- and periarticular soft-tissue swelling is frequent.

Rheumatoid Arthritis: In addition to the usual joint changes and sequelae, pericarditis is frequently seen in the juvenile form of rheumatoid arthritis. Pneumonitis and pleuritis may occur rarely.

The authors feel that pulmonary changes occur more frequently in the collagenous diseases than is usually appreciated. These changes are non-specific, although at times widespread. However, a knowledge that the patient has a polysystemic disease, together with diagnostic awareness on the part of the radiologist, should lead to a suggestion of the clinical possibilities and to further studies—clinical, laboratory, and pathological.

Twelve roentgenograms; 3 tables.

RICHARD E. OTTOMAN, M.D.
University of California

Foreign Body in the Abdomen Causing Obstruction. George L. Fair. Am. J. Surg. **86:** 472–475, October 1953.

Postoperative abdominal foreign bodies have been recognized since 1884. They include sponges, small or broken instruments, and pieces of equipment. Such a foreign body may produce infection, aseptic irritation, or adhesions. Usually its presence is suspected or discovered in the immediate postoperative period. Sponges are seldom retained in the abdomen for more than five years without giving rise to urgent symptoms.

Of interest to radiologists is the fact that calcium incrustation of a foreign body, as studied by the Crossens (Foreign Bodies Left in the Abdomen. St. Louis, C. V. Mosby Co., 1940) has invariably been associated with a communication to either the bladder or gastrointestinal tract. The case presented in this report is unusual in that calcification was apparent without gastrointestinal tract communication.

The patient was a 68-year-old colored female. Generalized colicky pain, nausea, and vomiting developed suddenly, and radiographic examination of the abdomen revealed a peripherally calcified mass in the left lower quadrant. The past history was negative except for a bilateral salpingectomy and oophorectomy, done as an elective procedure for pelvic inflammatory disease thirty years before. As the patient's condition became acute, a diagnosis of complete small bowel obstruction was made. A repeat roentgenogram of the abdomen showed a change in position of the mass to the upper mid-abdomen, with large dilated small bowel loops. Upon exploration, a partially calcified mass 8 cm. in diameter was found enveloped in the greater omentum and densely adherent to the inferior surface of the collapsed mid-transverse colon. A portion of mesentery had been torn, due to its attachment to this calcified mass, and an internal small bowel abdominal hernia had developed through the resulting mesenteric defect. The patient made an uneventful recovery following surgery, and has had no further complaints. Gauze fibers were distinguishable within the mass on pathological examination.

Two roentgenograms.

E. E. TENNANT, M.D.
Denver, Colo.

Excretion of Antibiotics, Dyes and Radioactive Substances through External Pancreatic Fistula. P. C. Rumore, G. A. Olander, and C. B. Puestow. Surgery **34:** 735–741, October 1953.

The authors studied the excretion of antibiotics, dyes, and radioactive substances through an external pancreatic fistula in a male patient, following marsupialization of a pancreatic cyst. Penicillin, Aureomycin, and Terramycin were not found in the pancreatic secretion. Streptomycin, on the other hand, was present in fair concentration in the pancreatic juice. Excretion of radioiodine, iodinated human serum albumin, and radioactive diiodofluorescein, revealed no special activity of the pancreas in relation to these substances. Amounts obtained in the pancreatic secretion corresponded to the amounts expected in tissue fluids. Studies of the chemical components in the pancreatic secretion revealed that most of the radioactivity was present in free iodine. Neither Congo red nor phenolsulfonphthalein was excreted in the pancreatic secretion.

By the use of gastric suction to decrease humoral stimulation of the pancreas and Banthine to decrease neural stimulation, the amount of secretion obtained through the fistula was markedly diminished, with a corresponding increase in amylase and lipase. The authors point out the possible hazards of attempting by this means to "dry up" pancreatic secretion in pancreatic disorders. The increased viscosity may lead to plugging of a duct or channel already narrowed, and the increased concentration of enzymes may lead to increased digestion of tissue.

One roentgenogram; 1 photograph; 1 table.

THEODORE E. KEATS, M.D.
University of California

TECHNIC

Simulated Color Roentgenography. Andrew H. Dowdy and Louis J. Bonann. Am. J. Roentgenol. **70:** 581–584, October 1953.

The authors present a method of simulated color roentgenography that is relatively simple and inexpensive. The examples of the color preparations are vivid and retain much of the detail of the original roentgenograms. This is an excellent teaching aid.

The reader is referred to the original article for the technical details of the process.

Two roentgenograms; 3 color roentgenograms; 1 table. SEYMOUR A. KAUFMAN, M.D.
Boston, Mass.

RADIOTHERAPY

Rotatory Irradiation at 400 kV. Johannes Thoms, C. B. Madsen, and Howard Nielsen. Acta radiol. **40:** 408–418, October 1953.

Following the installation of a G. E. Maximar "400" at the Radium Center in Aarhus, Denmark, it became possible for the authors to use voltages of 400 kv. and hence a harder quality of radiation than had previously been available for rotation therapy. The purpose of this paper is to present the isodoses found in new dose measurements in phantoms.

In rotatory irradiation, as in cross-fire treatment, it is of importance to realize to what extent it is possible to increase the depth effect of radiation, and in addition to determine the proper placement of the dosage maximum. From the measurements presented, it would seem that the change in the h.v.l. from 0.7 to 3.5 mm. Cu gives only limited advantages in rotatory irradiation of thoracic lesions. On the other hand, it appears to be possible to derive appreciable advantages from this form of therapy in the pelvic region, where the influence of the massive pelvic bones on dose distribution can be almost wholly eliminated. The ratio of the axis dose to the surface dose can be materially increased and a more appropriate dosage distribution obtained.

Since recurrence of cancer of the cervix is most frequently situated in the pelvis, it is of great importance that a considerably increased dose to the parametria can be obtained with rotation therapy at 400 kv. Possible late osteonecrosis of the neck of the femur as a complication of treatment is considered, but in the authors' opinion this risk, except in older patients, is not essential in comparison to the considerable advantages which are otherwise obtained.

Six graphs; 5 tables. JOHN R. SMITH, M.D.
Louisville General Hospital

Experience with the 30 MeV Synchrotron as a Radiotherapeutic Instrument. I. Development, Calibration and Instrumentation. J. S. Mitchell, C. L. Smith, D. J. Allen-Williams, and R. Braams. Acta radiol. **40:** 419–434, October 1953.

An investigation was undertaken to assess the value of 30-mev roentgen-rays in radiotherapy and to reach a decision as to the value of the 30-mev synchrotron (in the Radiotherapeutic Center, Cambridge, England) as a radiotherapeutic instrument. With the realization of the present limitations of their machine, the authors concentrated on the treatment of a few patients with lesions in particular sites for which radiotherapy by conventional methods would have been unsatisfactory. In all but one case, the treatment was radical, aiming at cure.

The present communication deals with the development of the technics necessary for the application of the synchrotron to practical radiotherapy, with special attention to accurate energy calibration and electronic instrumentation rather than methods of treatment in individual cases and results.

Included in the article are several diagrams of the general physical layout of the synchrotron, as well as a photograph showing the arrangements for treatment of an intracranial tumor, including the beam-directing device. JOHN R. SMITH, M.D.
Louisville General Hospital

Contact Irradiation of Surgically Exposed Tumors. Günther Barth. Strahlentherapie **91:** 481–527, 1953. (In German)

Surgical exposure and contact irradiation offer an opportunity to irradiate inoperable and certain intracavity tumors without the limitation of skin tolerance. The author, working in the University of Erlangen, used the Chaoul "oblique anode" and "pointed anode" tubes at 60 kv., 8 ma., and 5 cm. distance, without filtration. The tubes were cleaned with alcohol and covered with sterile gauze.

Fractionated dosages were used wherever feasible, with 400 to 500 r per sitting for an average total dose of 6,000 r in air. The overlying skin was rolled to the sides by making an incision over the center of the area and the upper and lower borders. Bulky tumors were surgically removed to a thickness of 2 cm. Wounds were closed after termination of the radiation series.

Details of the combined procedure are discussed and illustrated for the following conditions: metastatic tumors of the neck, parotid tumors, malignant goiter, orbital tumors, cancers of the sinuses, laryngeal tumors, carcinomas of the ear, tumors of the oral cavity, sarcomas of the bones and fascia, rectal tumors, cancers of the bladder, stomach, and pancreas.

No three- or five-year reports are yet available, but early favorable results were obtained with tumors of the parotid gland, sinuses, and larynx, and with subcutaneous metastases in the neck. Of 12 patients with cervical lymph-node metastases, 3 were without symptoms after four years. Six of 10 patients with cancers of the sinuses were symptom-free for three years.

Most cases treated were inoperable, with the exception of the laryngeal and parotid tumors, for which combined surgery and contact irradiation were used to avoid mutilating operations.

Heavy irradiation of neighboring bone must be avoided, particularly of the mandible.

Forty-eight photographs; 2 diagrams; 4 tables.
EUGENE F. LUTTERBECK, M.D.
Urbana, Ill.

Radiation Therapy of Malignant Brain Tumors. Victor Buchtala. Strahlentherapie **91:** 528–536, 1953. (In German)

To obtain a minimal tumor dose of 5,000 r in brain tumors, treatment must be protracted. The author

begins with 90 r daily for two weeks, followed by 180 r for a second two-week period, after which 225 r is delivered per sitting. The series covers from eight to ten weeks. Preoperative irradiation of glioblastoma is recommended.

With the above method, 137 patients were treated at the Department of Radiology and Neurology of the University of Würzburg, and 105 cases are evaluated in this report.

The average survival rate was as follows:

34 glioblastomas	7 months
24 gliomas	26 months
15 vascular tumors	22 months
14 pituitary adenomas	30 months
10 metastatic lesions	7 months
8 medulloblastomas	18 months

Radiation therapy of the pituitary adenoma in pregnant women should be done only during the second half of pregnancy.

Nine arteriograms; 1 table.

EUGENE F. LUTTERBECK, M.D.
Urbana, Ill.

Cancer of the Larynx Treated by 500 Kilovolt Roentgen Rays. J. Samuel Binkley. Am. J. Roentgenol. **70:** 591–598, October 1953.

Cancer of the larynx is divided into two anatomic groups: (1) growths arising in and limited to the vocal cords, ventricles, and subglottic regions, classified as cancer of the intrinsic larynx; (2) growths arising in the arytenoids, upper surfaces of the ventricular bands, aryepiglottic folds, epiglottis, piriform sinus, and postcricoid regions, classified as cancer of the extrinsic larynx. Each of these two groups is subdivided into four stages, depending upon the extent of the disease, from well limited lesions measuring 1.0 cm. or less in diameter (Stage I) to advanced disease with metastasis (Stage IV).

The results are given for 72 patients in whom cancer of the larynx was treated with 500-kv. roentgen rays. The estimated tumor dose was 5,250 to 5,480 r in the average neck, delivered in twenty-four to thirty days. In 5 cases the results were indeterminate. Of the 67 remaining cases, 46 were considered failures and 21 successes (alive without disease for five years or longer). This is a net five-year survival of 31 per cent. The majority of successes were obtained in patients with intrinsic lesions (18 cases) of Stages I and II.

Laryngectomy should be done in all cases with evidence of recurrence, as additional radiation does not appear to be of value in controlling the disease.

The author concludes that 500-kv. roentgen therapy offers a 60 per cent five-year survival rate in early (Stage I) lesions of the intrinsic larynx. It does not improve the outlook for the more advanced cases.

Two drawings; 1 graph; 2 tables.

SEYMOUR A. KAUFMAN, M.D.
Boston, Mass.

Treatment of Cancer of the Larynx by Interstitial Radium Needles. W. Douglas Harmer. Brit. M. J. **2:** 735–741, Oct. 3, 1953.

The delightful aphorism "use radium—plenty of it," does not apply to the larynx. Great care must be taken not to overdose the patient. The great advantage of the radium implant is that irradiation is highly localized, so that there is minimum interference with unaffected tissues. On the other hand, it is virtually impossible to give a uniform dose to the whole vocal cord by this method. In general, when an irradiated volume is fairly small, some non-uniformity in the dose distribution is tolerable, provided the lesion itself receives an adequate dose.

The "fenestration" operation consists in removal of the cartilage from one side of the larynx and the insertion of short radium needles into the growth. Not more than 12 needles are needed. For Stage I, four 2-mg. needles of an active length of 32 mm. are inserted vertically and one or two 1-mg. needles transversely. The screenage of these needles is 0.8 mm. platinum, which is found to produce less local reaction than 0.5 mm. For Stage II, rather larger doses are employed. A typical implant consists of four 2-mg. and two 1-mg. needles for a treatment time of one week. The anterior half of the vocal cord thus receives a dose of a least 6,000 r, and nearly all of the vocal cord at least 5,000 r. The fall-off in the dose toward the posterior end of the vocal cord may be partly counteracted by spacing the anterior needles, where the dose is high, rather more widely, so that the posterior needles are closer together. In any event, the position of the needles in an implant should be checked roentgenographically the day after implantation, and the optimum treatment time for the required dose calculated.

The lesions suitable for radium needling are the following:

(1) Early lesions (Stage I), even if the vocal cord is fixed. Lymph nodes are never affected in this group.

(2) Localized lesions in the anterior commissure without involvement of the base of the epiglottis or of the tongue. In this region the dose is always high, and needling usually succeeds in controlling the disease.

(3) Extensive lesions that appear to be intrinsic (Stage II).

(4) Subglottic lesions (really Stage III). In a few patients good results have been obtained, and there is no risk in trying this treatment first, but laryngectomy should be performed early, in a month or two, if the swelling persists.

(5) Lesions of the false cord and vestibule (Stage III). These growths are unusually malignant and difficult to cure. Probably needling plus laryngectomy is the best treatment.

Of 120 patients treated by implantation of radium needles, 117 were available for analysis. In Stage I (37 patients), there was an 87 per cent five-year survival and a 57 per cent ten-year survival. In Stage II (72 patients), there was a 37 per cent five-year survival and a 16 per cent ten-year survival. Of 9 patients with Stage III (extrinsic) lesions, 4 lived two years and 1 survived three years.

Eight illustrations; 4 tables.

DANIEL WILNER, M.D.
Atlantic City, N. J.

Carcinoma of the Breast. Results, Evaluation of X-radiation and Relation of Age and Surgical Castration to Length of Survival. George V. Smith and Olive W. Smith. Surg., Gynec. & Obst. **97:** 508–516, October 1953.

Methods of treatment and five- to twenty-year results in a forty-year series of 739 consecutive, unselected cases of cancer of the breast were tabulated to give a

background for critical analyses concerning the relationship of primary roentgen therapy, age at the time of operation, and prophylactic castration to the length of survival. All tumors were graded 1, 2 and 3, according to increasing histologic degree of malignancy. According to the analyses:

1. Primary roentgen treatment in conjunction with surgery prolonged life among patients with axillary metastases. From a separate study of the Grade 2 and Grade 3 cancers, evidence was obtained that roentgen therapy had been salutary only in patients with Grade 3 tumors. In this group, moreover, the higher rates of survival were found not only among those with positive nodes but also among those with negative nodes.

2. The lowest percentages of survivors were among women between the ages of forty and sixty, that is, during the premenopausal and postmenopausal climacteric.

3. Prophylactic ovariectomy prolonged life not only in women under forty and over fifty-nine, but more so in those between forty and fifty-nine years.

4. There was some evidence of lengthened survival from prophylactic x-radiation of the ovaries.

While some reporters do not believe that roentgen therapy is of benefit to patients with negative axillary nodes, the authors think that it would be wise to give it even to those without axillary metastases if the tumor is unequivocally of Grade 3 malignancy.

The presence of ovarian stromal hyperplasia implies continued secretion of estrogen. In those of the present group who were surgically castrated after the menopause, between the ages of forty-eight and sixty-nine, 91 per cent showed such hyperplasia. The clinical menopause may not be a true index of the hormonal state, and castration even after the "menopause" may prove to be of value.

Four graphs; 3 tables.

MORTIMER R. CAMIEL, M.D.
Brooklyn, N. Y.

Carcinoma of the Female Breast: Conservative and Radical Surgery. I. G. Williams, R. S. Murley, and M. P. Curwen. Brit. M. J. **2:** 787–796, Oct. 10, 1953.

This study represents an analysis of 1,044 *new* cases of mammary carcinoma seen in women at St. Bartholomew's Hospital from 1930 to 1939 inclusive, with follow-up of all but 30 patients, enabling ten-year survival rates to be calculated for the whole series of cases and fifteen-year rates for cases registered in 1930–35. The first author is a radiotherapist; the second, a surgeon; the third, a medical statistician.

All of the case records were scrutinized by the first two authors, and from the clinical information obtained and recorded all cases were staged. The method used was a modification of the "Manchester" system with four clinical stages. Distribution of the cases was as follows: Stage I, 32.5 per cent; Stage II, 28.9 per cent; Stage III, 27.4 per cent; Stage IV, 10.2 per cent; unstaged, 1.1 per cent. Distribution by age and location of the primary tumor was the same as in other published series. Pathological reports available in 448 cases in which axillary dissection had been done showed clinical assessment of axillary node involvement to have been incorrect in 29 per cent of Stage I cases and 23 per cent of Stage II cases. There was no definite correlation between length of history and lymph-node involvement.

Simple surgery was undertaken in 229 cases, more than half of which had only a simple excision of the tumor itself. Radical mastectomy was performed in 338 cases, and a modified radical mastectomy (simple mastectomy and axillary dissection without removal of the pectoral muscles) was done in 167. Radium treatment without surgery was used in 149 cases, some without histologic proof. X-ray treatment alone was given in 114 patients. Forty-seven cases were not treated. About two-thirds of the surgically treated patients also received radiation, and this type of treatment became more frequent toward the end of the period of study; at the same time, roentgen therapy tended to replace radium, particularly when combined with simple surgery.

Five- and ten-year survival rates, adjusted for variations in age distribution, were calculated for the different clinical stages and the grouping according to treatment. The adjusted rates for all the treated cases in Stage I yielded the following figures: five years, 72 per cent; ten years, 51 per cent; for Stage II, 39 per cent and 26 per cent, respectively. The rates for the individual treatment groups revealed no appreciable departures from these figures, even though over half the cases classified under simple surgery were treated by local excision only. The addition of irradiation did not affect the rates. An apparent paradox was the lower survival rates in the cases assessed clinically to be Stage II but with axillary nodes pathologically free, as compared with Stage I cases in which nodes were actually involved.

The mortality for radical mastectomy was 1.2 per cent. Edema of the arm occurred in 14 per cent of cases after radical surgery and in 5 per cent after simple surgery. There were fewer local recurrences after radical surgery than with the other types of surgery, and the addition of radiotherapy did not appear to alter this fact.

The authors present an interesting discussion of their findings with special comment on the views of McWhirter and Keynes and the methods of conservative surgery and radical radiotherapy. An excellent editorial on the treatment of breast cancer is included in this issue of the *British Medical Journal*, as well as an article concerning the treatment by estrogens of pulmonary metastases from mammary cancer. All radiologists should, if possible, read this issue.

Nine tables; 5 graphs. JOHN F. RIESSER, M.D.
Springfield, Ohio

Recurrences and Metastases in Cancer of the Breast. An Analysis of One Hundred Cases. Paul W. Hoffert and Eugene P. Pendergrass. Am. J. Roentgenol. **70:** 376–386, September 1953.

Having observed a definite cyclic chronological pattern in the appearance of recurrences and metastases of breast cancer in a number of patients, the authors sought to determine whether this occurred with any degree of regularity in a group of unselected cases. For this purpose they made a study of 100 cases from their files in which (with a single exception) death had occurred.

Although no clear-cut cyclic tendency in the development of recurrences and metastases was demonstrated, some interesting observations were made. The arithmetic mean number of years between the estimated onset of the disease and death for the group was three to four years, while the arithmetic mean number of years between onset and recurrence or metastasis was two to three years. It appeared further that, in 70 to 90 per cent of those who will have recurrences or metastases,

the first of these will appear within three years from onset of the disease. Among those who will have two or more recurrences or metastases, the second recurrence will occur within four years from onset in 59 to 96 per cent. Thus, in a patient surviving three years without recurrence or metastasis, the chance of its subsequent development is less than 30 per cent. Similarly, if a patient has had a single recurrence or metastasis but has not had a second within four years after onset of the primary disease, she has less than a 41 per cent chance of ever having another.

No significant difference in survival rate was noticed in the various therapeutic groups—surgery alone, surgery and postoperative irradiation, radiation alone, no treatment. However, patients treated by surgery plus irradiation and those treated by irradiation alone had a longer period of freedom from metastasis than those treated by surgery alone or those who were untreated.

Again it was shown that cancer of the breast in the young is more rapidly fatal than in the older age group.

The data obtained do not refute the fact that recurrences and metastases may—and indeed do—occur in individual patients in well recognized cycles.

Four graphs; 8 tables. G. E. Ross, M.D.
Indiana University

New Breast Form for Mastectomy Patients. Wolfgang Seligmann. Am. J. Surg. **86:** 466–467, October 1953.

The author describes a breast form designed specifically for the use of mastectomy patients. This consists of a double-cell structure fabricated from a soft skin-like plastic film. The inner cell contains a slow-flowing creamy fluid and is affected by gravity in precisely the same manner as the natural breast.

Two photographs.

The Treatment of Carcinoma of the Esophagus and Cardia by Resection and Postoperative Supervoltage Roentgen Rays. Herbert D. Adams, Hugh F. Hare, Wirt L. Davis, John G. Trump, and Richard C. Granke. Ann. Surg. **138:** 631–641, October 1953.

This is a study of 161 cases of proved carcinoma of the esophagus seen at the Lahey Clinic (Boston) in the period 1945–49, plus a consideration of postoperative rotational 2-million-volt irradiation instituted in June 1950. A number of tables are given showing sex and age distribution in the authors' series, pathological classification, and survival rate. The findings are in general agreement with the experience of others. Of the group of 161 patients, 25 were considered inoperable on first examination; 136 (84.5 per cent) were operated upon, but in only 69 was resection possible. For these resected cases the two-year survival rate was 29.5 per cent, the five-year survival rate 4.5 per cent.

Because of the poor results of surgery, the authors have sought to supplement this with supervoltage—2,000,000-volt—irradiation by the rotational technic. It has been possible to deliver 6,000 r in thirty-five days to a region including the area of resection and the surrounding lymphatics.

Two cases receiving supervoltage irradiation are reported. One patient had a squamous-cell carcinoma, Grade II, of the middle third of the esophagus. The treatment was well tolerated but death ensued due to metastases which had been known to be present before the irradiation was begun. The postmortem study showed no recognizable tumor cells in the esophagus. The second patient had a carcinoma simplex of the cardia of the stomach which could not be resected because of retroperitoneal extension. Two-million-volt roentgen treatment was given to the stomach for a total of 5,000 r in a series of 30 treatments in thirty-five days. Autopsy, about ten months later, revealed complete obliteration of the neoplasm except for a small area of malignant tissue buried in a fibrotic and necrotic area at the junction of the esophagus and stomach. The lymph nodes showed no involvement. [At present the radiologist is capable of delivering 6,000 r to the esophagus by supervoltage irradiation, the cobalt bomb, and even with the grid method. The authors of this paper favor operation first, then irradiation. The same principle is being followed in cancer of the breast with improved results. With better surgery and better irradiation, and search for early cases, the survival rate should show a decided improvement.—W. S.]

Two roentgenograms; 1 photomicrograph; 6 drawings; 10 tables. WILLIAM SNOW, M.D.
Shreveport, La.

Lymphosarcoma of the Gastrointestinal Tract. Clinical Observations and Methods of Treatment. Luigi Ciarpaglini. Radiol. med. (Milan) **39:** 737–759, August 1953. (In Italian)

Upon a review of the literature, it was found that there had been reported 136 cases of lymphosarcoma of the gastrointestinal tract. Of these 136 patients, 12 were still alive and in good health at the end of five years. Five of this latter number had been treated surgically and 7 with surgery followed by roentgen therapy.

The author reports 5 new cases, 2 involving the stomach, 1 the small bowel, and 2 the colon. All 5 patients were subjected to surgery followed by roentgen therapy with doses varying from 2,500 to 3,000 r per field at 200 kv., 10 ma, 0.5 mm. Cu plus 1 mm. Al filtration. All of these patients have now survived for periods varying from one to four years. The author believes that the combination of surgery and roentgen therapy is the treatment of choice in gastrointesinal lymphosarcoma.

Three roentgenograms; 12 photomicrographs; 1 photograph. CESARE GIANTURCO, M.D.
Urbana, Ill.

Comparative Radiotherapeutic Results in Carcinoma of the Cervix Uteri as Modified by Prior Surgery and Radiation. Howard B. Hunt. J. Iowa M. Soc. **43:** 403–408, October 1953.

The author reports an absolute five-year survival rate of 48.1 per cent for 318 previously untreated cases of carcinoma of the cervix: 211 of the group were state patients treated at the University of Nebraska Hospital, with an absolute five-year survival rate of 43.1 per cent; 107 were private patients treated at the Nebraska Methodist Hospital, with 57.9 per cent five-year survivals. All were managed by conventional radiotherapy.

An additional 28 cases had been modified by previous surgery. The absolute five-year survival rate for this group was 35.7 per cent. In the Stage I cases (League of Nations) the rate was 69.2 per cent as compared with 73.1 per cent in the group unmodified by prior operation; in Stage II, 14 per cent as opposed to 45 per cent for the previously untreated patients. In Stages III and

IV, there were no five-year survivals, though 17 per cent of those without earlier operation survived.

Twenty cases modified by prior irradiation showed only 1 five-year survival (5 per cent). In addition, the incidence of post-irradiation sequelae increased following re-irradiation.

The author concludes that the preferred primary treatment for clinical carcinoma of the cervix is a program of irradiation combining roentgen rays and radium.

Two graphs; 1 table. R. F. LEWIS, M.D.
Cleveland Clinic

Carcinoma of the Bladder: Review of 104 Cases from 1942 to 1952. Charles Pierre Mathé and Miguel Angel Llanos. J. Urol. **70**: 464–471, September 1953.

The authors point out that fixation of the bladder due to invasion of the wall by carcinoma is of greater prognostic significance than the size or location of the tumor or its grade of malignancy. They stress the importance of cystoscopic examination in cases of hematuria to detect early cancer, which may be missed on cystography. Early correction of vesical neck obstruction is also urged, as this seems to bear some relationship to the spread of the tumor. One case of bladder carcinoma is reported in detail, and 104 cases seen over a ten-year period are reviewed.

The case reported was seen in May 1951. Cystoscopy disclosed a large sessile growth involving the right base of the bladder. Bimanual palpation, under anesthesia, revealed fixation of the mass, with prostatic extension and obstruction, together with involvement of the pelvic lymph nodes. The mass was removed, and the patient was placed on 25 mg. of diethylstilbestrol daily. Postoperatively he received two courses of x-ray therapy—2,100 r (air) over the right abdomen and 1,950 r (air) over the posterior right pelvis—with a one-month interval between courses. Up to the time of the report he had shown no recurrence.

The series of 104 cases was variously treated. Radiation was used in 24 cases, in 2 of which radium was inserted through the open bladder. The authors prefer radiation therapy as an adjunct to surgery and have used it prior to partial cystectomy in order to seal lymphatic channels, thereby lessening the danger of spreading cancer cells during manipulation at the time of operation. They consider it of particular value in the treatment of papillomatosis and papillary carcinoma; its usefulness in leiomyosarcoma and epidermoid carcinoma is questionable.

The postoperative mortality rate for the series was 18.2 per cent. This high figure is attributed to the fact that in the majority of cases the patients were desperately ill, in the last stages of the disease. The survival rate was greater among patients seen earlier, whose treatment was augmented by relief of bladder neck obstruction, radiation and hormone therapy, and surveillance at regular intervals.

Four roentgenograms; 2 photomicrographs.
A. EDWARD O'HARA, M.D.
University of Pennsylvania

Radiotherapy of Cancer of the Penis. M. Lederman. Brit. J. Urol. **25**: 224–232, September 1953.

During the period 1929–52, 75 patients with cancer of the penis were seen at the Royal Cancer Hospital, London. Reliable information is available only on 61 previously untreated cases, and it is upon this group of patients that the author's observations are based.

The average age of the patients was sixty-two, the youngest being thirty-one and the oldest eighty-five; the largest number were in the decade sixty-one to seventy. Eighty per cent of the patients were treated within one year of onset of symptoms. In 36 patients the first symptom was a lesion on the penis. Three of the patients had been circumcised. None were Jewish or Mohammedan. Fifty-four of the tumors were squamous-cell carcinomas. Twenty-seven of the tumors arose from the gland and 31 from the prepuce, frenum, or coronal sulcus. In 3 cases the lesions were so advanced that the site of origin could not be determined. In 21 patients no lymph node metastases were demonstrable clinically; in 36 lymph node metastases were palpable but operable; in 4 lymph node metastases were fixed and inoperable.

Thirteen patients in the present series had immediate amputation of the penis, with routine irradiation to the inguinal lymph nodes. The remaining 48 patients were all treated initially by irradiation; 13 required subsequent amputation of the penis, 2 block dissection, and 4 both amputation of the penis and block dissection. Of the 48 patients in whom irradiation was initially employed, 27 were treated by teleradium (radium bomb), 14 by radium applicator, and 3 by roentgen rays. Radium implantation (4 cases) has not been used since 1932 because it is more liable to be followed by undesirable complications. Of 44 patients treated by radiation and observed for five years or more, 13 (30 per cent) survived without the aid of surgery. Operation upon 13 "irradiation failures" resulted in a salvage of 11 additional patients, bringing the survival rate to 54 per cent. Four of 11 patients treated by surgery alone were alive at the end of five years (36 per cent).

Nine tables; 1 graph.

The Roentgen Diagnosis and Indications for Radiation Therapy of Bone Tumors. U. Cocchi. Fortschr. a. d. Geb. d. Röntgenstrahlen **79**: 421–435, October 1953. (In German)

The author classifies bone tumors as benign, conditionally benign, and primary malignant, adding two further groups, namely parosteal tumors and rare tumors of bone such as hemangioendothelioma and neurosarcoma. The clinical findings and the type of periosteal reaction in various bone diseases are described. The history, age and sex of the patient, x-ray findings in other bones and in the lungs, laboratory tests, biopsy findings, and occasionally the results of test irradiation, have to be considered in arriving at a diagnosis.

The radiosensitivity of various tumors determines the indication for x-ray therapy. Radiation sensitivity and cure rate, however, do not parallel each other, since radiosensitive tumors also grow rapidly and metastasize early. Prompt diagnosis and early treatment are essential for the successful management of bone tumors, as well as of other neoplasms.

For bone hemangiomas, osteoclastoma, reticulosarcoma of bone, Ewing's sarcoma, and plasmocytoma, irradiation must be considered the treatment of choice. The author's results in these tumors following radiotherapy alone or in combination with surgery were as follows:

	Five-year survivals symptom-free	*Average duration of life*
Hemangioma	72.7%	.....
Osteoclastoma	87.2%	5.7 years for 4 malignant cases
Osteoplastic sarcoma	12%	16.4 months
Ewing's sarcoma	8%	19 months
Reticulosarcoma	42.8%	6 years
Plasmocytoma	5.8%	2 years, 3 months

Total doses ranged from 2,000 to 10,000 r.

These results are based on small numbers of cases. Additional experience gained by close cooperation between pathologist, surgeon, and radiotherapist is required for more reliable conclusions.

Sixteen roentgenograms; 4 tables.

JULIUS HEYDEMANN, M.D.
Chicago, Ill.

Anti-inflammatory Roentgen Therapy. J.-H. Marchand and A. Corbier. **Anti-inflammatory Radiotherapy in Proctology.** P. Hillemand and J.-H. Marchand. **Radiotherapy in Treatment of Rheumatism.** J.-H. Marchand, S. deSèze, and J. Bennett. **X-rays in Stomatology.** H. Crocquefer and J.-H. Marchand. **Radiotherapy of Inflammatory Affections of the Skin and Subcutaneous Tissue.** J.-H. Marchand, J. Clautour, and J. Bennett. Semaine d. hôp. Paris: **29:** No. 65, Oct. 26, 1953.

These five papers are presented as a small collection in the form of a supplement, the purpose being to encourage the use of radiation therapy in inflammatory diseases. Attention is directed to the increased speed of resolution of inflammatory changes and localization of suppurative lesions in relation to proctology; the use of irradiation to abort the early tissue reactions caused by rheumatic disease; the use of small doses of irradiation therapy in stomatology to control inflammatory changes as a prelude to surgical approach or to minimize the sequelae; the use of irradiation in inflammatory infections of the skin and subcutaneous tissues, including the breast. Although the exact mode of action of irradiation in various inflammatory diseases is not completely understood, the authors believe that definite benefit is obtained with judicious irradiation therapy in selected inflammatory conditions.

CHARLES NICE, M.D.
University of Minnesota

Radiotherapy of Arthrosis Due to Old Congenital Dislocation of the Hip. Franco Fugazzola. Arch. radiol. **28:** 248–252, 1953. (In Italian)

Since surgery at times does not relieve the pain associated with an old congenital hip subluxation, a trial of irradiation was undertaken in a group of about 20 patients. Some had never been surgically treated, and some had been treated without success. Most of the group were women. All were between thirty and fifty years of age and had been complaining of pain for two or three to ten or more years. In the majority of cases, there was a functional limitation as well. The radiologic picture varied widely, both as regards the degree of luxation and of arthrosis. Periods of observation extended from six months to two years from the beginning of therapy.

Irradiation was given through three fields, anterior, lateral, and posterior, over the malformed joint, with the following factors: 180 kv., 6–8 ma., filter 0.5 mm. Cu plus 3 mm. Al, 30 cm. distance. The dose was 150 r per sitting, to a total of 450 to 600 r to each field.

In all cases considerable improvement was obtained, with complete disappearance of pain in the majority. There was also functional improvement, with a certain resistance to fatigue and an attenuation of muscular contractures. Relapse in 3 cases was successfully treated by another course of radiotherapy. In some instances there was an initial accentuation of the pain. Control roentgenograms showed no significant change.

CHRISTIAN V. CIMMINO, M.D.
Fredericksburg, Va.

Calorimetric Evaluation of the Roentgen for 400 kv. and 22.5 mev. Roentgen Rays. J. S. Laughlin, J. W. Beattie, W. J. Henderson, and R. A. Harvey. Am. J. Roentgenol. **70:** 294–311, August 1953.

As the range for secondary electrons produced by high-energy roentgen rays increases greatly with energy, their measurement by air ionization methods becomes difficult and interpretation more ambiguous. In addition, such methods measure absorption of radiation or dose, rather than intensity or flux, which applies to the output of generators. In order to provide a means of directly determining the energy output of roentgen-ray generators which would be free from the limitations mentioned above, the calorimetric method of measurement has been developed. This method has proved to be extremely sensitive and accurate, and capable of easily reproducible measurements. It is sufficiently sensitive to be applicable to any roentgen-ray generator in use, and the apparatus is portable.

The calorimetric method as described here employs the use of thermistors (thermally sensitive resistors). With these elements, a linear relationship exists between the logarithm of the resistance plotted as a function of temperature. The calorimeter was designed with the objective of absorbing the incident radiation in a body which was thermally insulated from its environment. The temperature change in the absorbing body is measured by means of the resistance change in an imbedded thermistor. The resistance change is determined by the amount of resistance necessary to balance a Wheatstone bridge. The thermistors are imbedded in silver-plated brass shells, which are filled with lead. These lead cylinders also contain a wire heating coil. These cylinders are then suspended in a silver-plated box which can be evacuated and either of the two cylinders radiated through plastic ports. The apparatus is surrounded by a constant temperature oil bath. The calorimeter was calibrated by making experimental runs with a known amount of energy dissipated in the absorbing cylinder by the imbedded heating coil. This coil was made of constantan and soldered in a groove to establish good thermal contact.

The authors suggest that such a calorimetric method of flux determination can be made the fundamental calibration of the output of roentgen-ray generators, particularly for generators above 1 mev.

The interested reader with a good background of physics and mathematics is referred to the original article.

Three photographs; 11 graphs; 4 drawings; 1 table.

JAMES H. GROVE, M.D.
Mt. Sinai Hospital of Cleveland

RADIOISOTOPES

Radioactive Gold in the Treatment of Malignant Effusions. William B. Seaman, Alfred I. Sherman, and MacDonald Bonebrake. J.A.M.A. **153:** 630–633, Oct. 17, 1953.

Forty patients having malignant pleural effusions which rapidly re-accumulated after thoracentesis and produced respiratory embarrassment were given radioactive gold intrapleurally, the usual dose being 100 mc. In 5 patients bilateral intrapleural injection was done. Eight patients received radioactive gold in both the peritoneal and pleural cavities. Palliation, as evidenced by inhibition of fluid formation, was achieved in approximately one-half of the cases. Of the 26 patients surviving more than one month following treatment, 20 experienced significant palliation.

Two patients with malignant pericardial effusions were treated with radioactive gold. One received 90 mc intrapericardially and 100 mc intrapleurally. The pericardial effusion did not respond to the treatment, but pleural effusion was inhibited. A second patient received 100 mc of Au^{198} intrapericardially and showed an excellent response during a four and one-half month follow-up.

Radioactive gold was also given to 42 patients having malignant ascites. Of 27 patients who lived longer than one month, and therefore could be evaluated for degree of palliation, 20 were helped. In some cases radioactive gold therapy retarded fluid reaccumulation for as long as four to six months.

This mode of therapy was generally well tolerated. No significant radiation sickness occurred. A low-grade fever appeared in several cases following intrapleural treatment, but the relation of the fever to the isotope was obscure. The only hematologic change noted was a mild leukopenia. Response to treatment was not influenced by the site of the primary tumor nor by the location of the effusion. All patients treated in this manner should be hospitalized for the treatment and for as long as they harbor more than 30 mc of radioactivity.

Calculations indicate that the injection of 100 mc of radioactive gold into the average adult peritoneal cavity having a surface area of 30,000 sq. cm. results in a surface dose of 3,000 rep, assuming even distribution of the isotope over the entire surface.

Four roentgenograms; 3 tables.

RICHARD F. MCCLURE, M.D.
Palos Verdes Estates, Calif.

Treatment of Carcinoma of the Prostate. R. H. Flocks. J. Urol. **70:** 491–498, September 1953.

The purpose of this report is to outline therapy for carcinoma of the prostate on the basis of over 850 patients treated at the State University of Iowa Hospital from 1926 to the present and to review the results of other observers as reported in the literature.

In the Group I lesions, limited to the capsule, which comprise 5 to 10 per cent of the cases, surgery is the treatment of choice and can be expected to give 50 per cent five-year "cures."

In the lesions with extracapsular local spread, Group II, which comprise 55 per cent of the cases, the treatment is less definitely fixed. Most of the patients are over seventy and have bladder neck obstruction. These cases can be approached by radical surgery (pelvic evisceration) in an attempt at cure or they can be treated palliatively, with transurethral resection plus hormones and irradiation. External irradiation has been found to produce severe bowel and bladder symptoms when given in amount sufficient to affect this relatively resistant tumor. In an attempt to add irradiation to the armamentarium, interstitial colloidal gold, placed by a suprapubic operative exposure, has been used. Localization of the material is aided by the tight fascial planes of the area.

Sixty-nine patients were treated with 1 to 1.5 mc of Au^{198} per cubic centimeter of tissue, for a total dose not exceeding 150 mc, since beyond this amount the gamma emission becomes significant. Large tumors therefore receive relatively less radiation than smaller ones. The material is injected with a lead-covered syringe and a screw type of pressure applicator to force the gold through the tissue. The most important precaution is to avoid puddles of radioactive material in the sensitive rectal wall. No case to date has shown bladder irritation. One-third of the patients have had mild to severe rectal symptoms. In 1 instance colostomy was required. One patient died of idiosyncrasy to gold itself. One patient appears clinically to be cured at two years. Fifty per cent of the cases were clinically controlled. Two patients have had residual tumor treated by injections through the perineum with good response.

In Group III cases, with distant spread, the best results have been obtained with surgical relief of the bladder neck obstruction and hormones. Stilbestrol and orchiectomy concomitantly give better results than either alone. No better palliation was obtained from large doses of estrogens than from moderate amounts. Data on adrenalectomy in advanced disease is being collected.

Five illustrations; 1 table.

PATRICIA BORNS, M.D.
University of Pennsylvania

Localization of Radioactivity in the Lung and the Lymph Nodes. J. Ray Bryant, Harold F. Berg, and William M. Christophersen. J. Thoracic Surg. **26:** 221–231, September 1953.

This is a report of experimental methods of delivering effective radiation to specific segments of the lung and to regional lymph nodes. The methods were of two types: (1) direct instillation of Au^{198} into a single lung segment by use of a bronchoscope, injection being made through a ureteral catheter; (2) direct injection of the same solution into the submucosa of an intermediate bronchus, by means of a long needle introduced through a bronchoscope. Phagocytic activity carried the colloids through the lymph channels to the recipient lymph nodes.

The experiments were performed on dogs, which were sacrificed at periods ranging from five to sixty-one days after administration of the isotope. After sacrifice, wet digested tissue samples were measured for radioactivity with an end-window Geiger-Müller tube. Correlation was made with changes observed in histologic sections.

The lung changes varied with dosage and time. At twelve days following a dose of 3 to 5 mc of Au^{198}, edema, congestion, atelectasis, alveolar septal thickening with some necrosis, and organizing granulation tissue were found. In this group no vascular changes were identified. With longer periods and greater

amounts of radioactive gold (15 to 35 mc), greater degrees of necrosis and larger amounts of granulation tissue with epithelial destruction were observed. In one animal, at sixty-one days there was marked fibroblastic proliferation, both parenchymally and pleurally. In addition, obliterative endarteritis and endophlebitis were noted. No liver damage was demonstrable in any of the animals, indicating little circulation of the colloidal isotope in the blood stream.

A maximum localization of radioactivity was obtained in the lung by the instillation method. By the injection procedure extreme localization occurred in the hilar nodes. Only healthy dogs were used and the authors feel that it is quite possible that concentration in the lymph nodes might not attain so high a level in the human being with carcinomatous involvement of these nodes. They believe that a combination of the two methods may be a means of delivering sufficient radiation to afford some palliation to patients with far advanced cancer of the lung and hilar mediastinal carcinomatosis.

[Weinberg (Identification of Regional Lymph Nodes in the Treatment of Bronchogenic Carcinoma. J. Thoracic Surg. **22**: 517, 1951), using Pontamine sky-blue, found that colloidal material was phagocytosed and moved rapidly in the lymph streams to the regional lymph nodes but outlined only the healthy lymphoid tissue. This suggests that the carcinomatous tissue might be surrounded but not infiltrated by colloidal material.—R. E. O.]

Four illustrations; 1 table.

RICHARD E. OTTOMAN, M.D.
University of California

Radioiodine Uptake in the Study of Different Types of Hypothyroidism in Childhood. Samuel H. Silverman and Lawson Wilkins. Pediatrics **12**: 288–299, September 1953.

The authors studied the radioiodine uptake in 34 children with definite clinical and biochemical signs of hypothyroidism. These studies were undertaken in the hope of obtaining an explanation for the marked variations in symptomatology of hypothyroid children and some information concerning possible etiologies. It was felt that the presence or absence of small amounts of thyroid tissue might be demonstrated which could be correlated with the relative mildness or severity of the symptoms.

Each patient was given 1 microcurie of I^{131} per kilogram of body weight, intravenously to avoid possible skin contamination. All uptakes were recorded in counts per second with the use of a Victoreen end-window Geiger-Müller tube and Tracerlab autoscaler.

Of the 34 children, 14 had been previously treated or were under treatment at the time of the study. This group showed no uptake of I^{131}. Nine were retested forty-eight hours after intramuscular injection of 30 mg. of thyrotropic hormone but again showed no demonstrable uptake. Since it was impossible to conclude whether this lack of function was due to atrophy of the gland following treatment or to congenital absence of gland tissue, these 14 cases were excluded from the study. The 20 remaining children all showed marked hypothyroidism. Although no differences in degree could be ascertained clinically or by means of serum cholesterol, basal metabolism, or circulation studies, in these patients, 9 were found to have no uptake of I^{131}, 9 had small uptake, and 2 a normal uptake. Unfortunately, the authors were unable to make measurements of the protein-bound iodine of the serum.

The 20 cases are divided clinically into two categories: (1) congenital hypothyroidism, in which the onset of symptoms occurred from birth to one year of age; (2) acquired hypothyroidism, in which the symptoms appeared from one to twelve years of age. There were 14 patients in the first group and 6 in the second.

In 4 patients of the congenital group, the thyroid took up small amounts of I^{131}. Clinically these differed from the 10 who showed no uptake in that their symptoms developed more slowly and they lacked typical cretinoid facies. The authors believe that this suggests that the more typical cretins were born without any thyroid tissue, while the others had small amounts of tissue with sufficient activity to delay the onset of the typical picture. There were 2 additional patients clinically placed in the congenital hypothyroidism group who had normal I^{131} uptakes. One of these had a moderate-size goiter, but neither showed any indication of iodine deficiency. The authors felt that the glands of these patients were either unable to convert inorganic iodine to thyroxine or to secrete thyroxine if it was formed. One of the 2 was given 2 gm. of KSCN orally after I^{131}, following the method of Stanbury (J. Clin. Endocrinol. **10**: 1471, 1950), in an effort to remove any unbound iodine from the thyroid. Two successive attempts with KSCN, however, failed to decrease appreciably the activity of the gland. The authors had no explanation for this.

All of the 6 patients in the acquired hypothyroidism group showed slight I^{131} uptake, indicating that small amounts of thyroid tissue were present. Five of these failed to respond to TSH stimulation; 1 showed a normal uptake after TSH. The authors conclude, along with Weaver (J. Clin. Endocrinol. **10**: 1054, 1950), that the deficiency in such a situation is due to lack of thyroid stimulating hormone. This patient, however, had no other signs of pituitary dysfunction.

Two tables; 2 charts.

R. F. LEWIS, M.D.
Cleveland Clinic

Blood Isotope Levels Following a Test Meal of I^{131}-Labeled Protein. Austin B. Chinn, Paul S. Lavik, Louis I. Babb, G. Warren Buckaloo, Richard M. Stitt, and William E. Abbott. J. Lab. & Clin. Med. **42**: 377–379, September 1953.

Previous studies (Pediatrics **10**: 667, 1952, and New England J. Med. **247**: 877, 1952. Abst. in Radiology **61**: 469, 697, 1953) showed that impaired protein digestion in persons with marked pancreatic insufficiency may be determined by measuring the fecal excretion of isotope following a test meal of I^{131}-labeled protein. Although blood levels of isotope in these patients were generally below those in persons with normal digestion, the rate of absorption in both groups was so slow that all values were too low to make the difference between them significant. In a number of additional observations, utilizing varying quantities of non-radioactive protein in the test meal, the rate of absorption of ingested isotope by normal persons was found to be roughly inversely proportional to the amount of administered protein. The present communication is concerned with observations made with an amount of non-radioactive protein in the test meal which resulted in maximum isotope blood levels in persons with normal digestion, two to three hours after its administration.

Sixteen persons with normal protein digestion and 3

with marked pancreatic insufficiency were given a test meal of 100 μc. iodinated albumin and 0.5 gm. gelatin per kilogram of body weight. In the persons with normal digestive processes, the isotope content of the blood rose sharply during the first one to two hours following the test meal and then leveled off. With only one exception maximum blood levels were obtained within three hours after the test meal, and at two hours following the test meal none of these patients had blood values less than 10 per cent of ingested isotope. In contrast, the 3 patients with pancreatic insufficiency showed a much lower isotope content of the blood, none exceeding 3 per cent of the ingested dose. Delayed gastric emptying as the cause of these low values would seem to be eliminated by the fact that maximum blood values were obtained in the same time sequence as in the normal subjects.

By utilitization of the test meal of lower protein content described above, it seems likely that defects in both the rate and extent of protein digestion or absorption might be detected in one simplified procedure.

One chart.

Factors Influencing the In Vitro Uptake of Radiophosphorus by Human Erythrocytes. A. R. Feinstein, E. L. Gordon, and W. F. Bethard. J. Lab. & Clin. Med. **42**: 165–177, August 1953.

The authors have developed a new index for expressing P^{32} uptake by erythrocytes. It is determined from the following experimentally established equation: $K_e = (U/D)(V_t/V_f)$, where U is the uptake in the red cell mass, D is the incubated dose of P^{32}, V_t is the total suspension volume, and V_f is the volume of packed red cells. This new index, K_e, represents the specific affinity of the red cell for P^{32} under standard conditions of incubation, and it makes provision for the effects of hematocrit and total solution volume upon erythrocyte P^{32} uptake.

Irradiation has been shown to have little or no effect on the human erythrocyte uptake of P^{32}, and this method, therefore, is not suitable for use as an *in vitro* screening technic for proposed anti-irradiation agents.

Erythrocyte K_e values were found to show no consistent variation over a wide range of clinical disease conditions.

Storage of red cells with varying amounts of glucose at different times and temperatures suggests that the K_e of the surviving cells reflects their viability. It is proposed that this might be a simple, useful tool in the search for more effective methods of blood preservation.

Four illustrations; 5 tables.

The Urinary and Fecal Excretion of I^{131} from Labeled Sodium-*l*-Thyroxine in Various Thyroid States and in Euthyroids with "Bile Fistulas." Philip C. Johnson and William H. Beierwaltes. J. Lab. & Clin. Med. **41**: 676–683, May 1953.

Various thyroxine preparations have been found to be less active when given orally than when given intravenously. This difference has been ascribed to relatively poor absorption of thyroxine from the gut. The per cent absorption of a dose of thyroxine given orally to animals has been reported to vary from 6 per cent to 50 per cent. Recently, however, Myant and Pochin (Clin. Sc. **9**: 421, 1950) gave I^{131}-labeled Na-*l*-thyroxine to euthyroid human adults orally and by vein and found that after oral administration of this compound the accumulation of I^{131} in the thyroid, urine, and feces, and the composition of plasma radioiodine were comparable to the values obtained after intravenous administration of the same compound. These figures were consistent with complete absorption of Na-*l*-thyroxine from the gastrointestinal tract. The present authors submit additional evidence that Na-*l*-thyroxine may be well absorbed but re-excreted through the gut wall into its lumen.

Four patients were studied: one myxedematous, one artificially hyperthyroid, and two euthyroid adults with biliary fistulas. They were given oral "tracer" doses of less than 0.3 mg. of Na-*l*-thyroxine labeled with 585 to 924 microcuries of I^{131}. Total six-day I^{131} excretion in urine and stool was similar in magnitude in the 4 patients. A paucity of biliary excretion of thyroxine I^{131} was found. This finding, plus the fact that the fecal excretion of thyroxine I^{131} was the same in both the patients with bile fistulas (24 to 32 per cent of administered Na-*l*-thyroxine I^{131}) and in intact patients (21 to 27 per cent), indicates that thyroxine is present in the feces not because of high excretion by the liver *via* the bile into the gut, but either through lack of absorption from gut or active excretion through the gut wall. The fact that the metabolism of intravenous thyroxine and oral thyroxine has been shown to be comparable suggests that thyroxine is actively secreted through the gastrointestinal wall into its lumen.

Four charts; 2 tables.

Dosimetric Considerations in Determining Hematopoietic Damage from Radioactive Iodine. J. E. Rall, Charles G. Foster, Jacob Robbins, R. Lazerson, Lee E. Farr, and Rulon W. Rawson. Am. J. Roentgenol. **70**: 274–282, August 1953.

The main toxic effect of large doses of I^{131} appears to be exerted on the blood-forming organs. There is, however, no correlation with the dose as measured in millicuries. The authors undertook the study reported here to answer the following questions:

1. What is the most reliable and sensitive indication of radiation damage from I^{131}?
2. What is the most accurate means of determining the radiation actually delivered by any large dose of I^{131}?
3. Can the amount of radiation delivered by any large dose of I^{131} be predicted by a prior tracer study?

I^{131} was administered orally to 33 patients. The urine was assayed for radioactivity by a Marinelli cup counter. Blood and *in vivo* measurements were made with a Texaco gamma-ray tube. Blood counts were performed daily for at least thirty days after administration of any large dose of I^{131}. The level of the isotope in the blood was determined daily for at least twenty-five days. The last specimen was then extrapolated to infinity.

The radiation received by the blood-forming organs from the blood was calculated from the formula of Marinelli, assuming complete absorption of these rays. The integrated dose of I^{131} retained by the patient was plotted as the difference between the amount administered and that excreted in the urine. In calculating the amount of radiation that the blood received from I^{131} that was concentrated in any area of the body, it was assumed that all beta rays from the I^{131} were absorbed in tumor or thyroid and did not contribute to the radiation received by the blood-forming organs. Gamma radiation approximations were made on the assumption that the

body is a cylinder of 60 cm. height and 20 cm. radius, and it was further assumed that approximately half or less of the calculated amount would not reach blood-forming organs, since much of the energy would be absorbed in the first 5 cm. or so of tissue. This radiation is referred to as "body retention" radiation.

Arbitrarily, a specific body retention factor was chosen on an empirical basis. There was then shown to be close correlation with the lymphocytic fall and the radiation received by the blood-forming organs, as calculated by the blood radiation plus the body retention factor. A similar close correlation was found with the integrated blood concentration of radioiodine in the same patient, after a tracer or therapeutic dose, but only if the retention was less than 115 millicuries in forty-eight hours.

The authors conclude, that: (1) The lymphocyte fall after large doses of I^{131} is well correlated with the integrated blood concentration of this isotope, plus an empirical factor derived from the integrated amount of isotope retained in the body. (2) In patients who retain less than 115 millicuries of radioiodine in forty-eight hours it has been possible to predict from tracer studies the amount of radiation that a large dose of I^{131} will deliver.

Four graphs; 5 tables. JAMES H. GROVE, M.D.
Mt. Sinai Hospital of Cleveland

Radioactive Iron Absorption in Siderosis (Hemochromatosis) of the Liver. Ralph E. Peterson and Richard H. Ettinger. Am. J. Med. **15:** 518–524, October 1953.

Tracer quantities of Fe^{59} were given orally to two patients with siderosis of the liver. The iron was followed by balance technic and determination of serum level and red cell uptake. Increased amounts (20 to 45 per cent) of the administered iron were absorbed as compared to the absorption in 4 normal subjects similarly studied (1 to 4 per cent). It was found that in the presence of large amounts of stored iron the amount of iron absorbed is greater than the amount which appears in the red blood cells.

The following conclusions pertaining to the treatment of hemochromatosis are suggested: (1) The absorption of iron is probably not related to body needs. (2) The defect in hemochromatosis is increased absorption of iron. (3) There is no mechanism to provide for the excretion of significant amounts of iron. (4) Iron stores may be reduced by multiple phlebotomies. (5) Compounds that form unabsorbable iron complexes, such as phosphate salts, should be administered with meals.

Three photomicrographs; 1 table.
HOWARD L. STEINBACH, M.D.
University of California

Exposure of Human Cardiac Muscle to Radioactive Digitoxin in vitro. Walter J. Burdette. Am. Heart J. **46:** 602–606, October 1953.

Previous experiments having shown that lanatoside C (a glycoside obtained from *Digitalis lanata*) acts directly on the myocardium to increase oxygen consumption of the tissue, a further study was undertaken in extension of this work.

Slices of human cardiac muscle obtained by biopsy at the time of exploratory thoracotomy were incubated with C^{14}-labeled digitoxin, in Warburg vessels. At the end of the incubation period, potassium hydroxide was removed from the vessel, and the center well was washed with distilled water, previous control studies having shown that such washing removes all active material. One-half milliliter of 8 per cent NH_4Cl was added to the KOH washings, and the C^{14} present in dissolved $C^{14}O_2$ was precipitated as $BaC^{14}O_3$ by addition of 1 ml. of $BaCl_2$ (79 mg. per milliliter) solution. The crystals were washed with 95 per cent ethanol and filtered on filter paper, which was then transferred to a brass disk for counting, after drying. Counts of radioactivity were made with a thin-window Geiger-Müller tube and also with an open-window flow counter. No radioactivity was detected in the samples, even though the slices respired at increased rate in the presence of glycoside. This suggests that digitoxin acts catalytically, without conversion to $C^{14}O_2$ by the tissue.

Three tables. THEODORE E. KEATS, M.D.
University of Calif.

The Effect of Roentgen Radiation on the Incorporation of Radiophosphorus into Nucleic Acids and Other Constitutents of Mouse Mammary Carcinoma. Halvor Vermund, Cyrus P. Barnum, Robert A. Huseby, and Karl W. Stenstrom. Cancer Res. **13:** 633–638, September 1953.

The authors report the effect of roentgen radiation on the incorporation of P^{32} into various organic compounds of transplanted mouse mammary carcinomas. They compare their observations with those of numerous other investigators. For an adequate appreciation of their findings, the article must be consulted in the original.

It bears emphasis again that, at least in these mouse mammary carcinomas, the effect of x-radiation is amazingly specific. It blocks steps leading to the formation of new DNA (desoxypentosenucleic acid) but is without demonstrable significant effect on the incorporation of P^{32} into PNA (pentosenucleic acid), phospholipides, or "phosphoproteins."

One chart; 6 tables.

The Fate of Radiophosphorus Ingested by Habrobracon Females. Daniel S. Grosch and Robert L. Sullivan. Biol. Bull. **105:** 296–307, October 1953.

In a previous publication (Biol. Bull. **102:** 128, 1952. Abst. in Radiology **60:** 477, 1953) the changes in the number of eggs produced per day and in their hatchability were reported for Habrobracon wasps fed honey containing P^{32} in dosages ranging from the tracer level into the intermediate level of internal therapy (10 μc. to 1,500 μc.). In the study now described the authors gave detailed chronological attention to excretory and ovipositional loss of radioactive substance subsequent to a single feeding of a mixture of honey and P^{32} at various levels of radioactivity lower than the sterilization dose of 200 μc. per gram of mixture.

The biological half-life of radiophosphorus in egg-laying Habrobracon females is four to five days. A majority (about 60 per cent) of the P^{32} lost is by way of deposited eggs. This is based upon excretory studies using a newly devised technic and upon comparisons of laying and non-laying wasps. Direct evidence of radioactivity was also obtained from the eggs.

The radioactivity of the eggs rose to a peak on the second day after feeding. Subsequent to the third day, it dropped sharply to a relatively low plateau. The variability in radioactivity from egg to egg was greatest on the first day. It may prove to be less each succeeding day.

During the first day almost 90 per cent of the ingested radioactive material was abdominal due to the location of the crop. From the second to the fourth day, about 65 per cent of the radioactivity in the female was abdominal. Subsequently abdominal radioactivity approached 50 per cent of the total. Of these proportions, less than one-third may be gonadal.

Although it is an important factor in the regulation of total radioactivity, egg laying has not been found significant in determining P^{32} distribution.

The shape of the hatchability curve previously reported for eggs from females fed P^{32} is interpreted for the first five days on the basis of gamete-incorporated radiophosphorus. Subsequently, initial exposure and accrued total dose may have greater significance.

Four graphs; 2 tables.

A Method of Preparing Radioautographs with Adjacent Sections. Titus C. Evans and Walter E. McGinn, Jr. Cancer Res. **13:** 661–665, September 1953.

A method of preparing radioautographs is described which consists essentially of utilizing two adjacent sections. One section in inverted on the cover-slip and is also used to produce an autograph by the temporary-mount method. The other section is mounted permanently on the same emulsion. The result is three images in a line on the same slide. These are the tissues alone, the tissue-autograph preparation, and the autograph alone. The advantages of the method are: (*a*) Regions of particular interest in the tissue-autograph preparation can be located easily in the tissue section where the histologic structure may be studied without the interference of the photographic grain which is present in the autograph. (*b*) Possibility of artifact in the tissue-autograph section can be checked by studying the autograph alone. Possible disadvantages are: (*a*) In addition to the inherent limitations of resolution, the structures vary by the thickness of the sections (about 8 μ). (*b*) The technic requires patience and is more time-consuming than routine methods.

One chart; 3 photomicrographs; 3 tissue-autographs; 3 autographs.

RADIATION EFFECTS

Radiation Hazard During Angiocardiography. William Dubilier, Jr., Harry W. Burnett, Charles T. Dotter, and Israel Steinberg. Am. J. Roentgenol. **70:** 441–444, September 1953.

In view of the potential hazard to both the patient and the examiner during the multiple exposures of angiocardiography, the authors have made a study of the effectiveness of their methods of protection during this procedure. They employ the Fairchild camera, making ten exposures at a distance of 48 inches, 20 ma., and 0.1 sec. exposure time, at 75 to 90 kv., depending on the thickness of the patient. Measurements were made with both large and small cones giving fields 24.6 and 18.3 inches in diameter, respectively. It was found that the exposure was cut in half by the use of the smaller cone.

Measurements were made at the level of the examiner's hands with and without the protection of an Archer type three-ply lead gown. With the small cone, the dose at the injector's hands with the protective apron was approximately 2.0 mr per exposure. Thus with the average of ten exposures per examination, he could do 15 examinations per week without exceeding the dose of 300 mr recommended by the National Committee on Radiation Protection. The authors feel that with their technic the examination can be done without undue hazard using the Archer gown and the standard lead apron to protect the torso. No additional bulky lead barriers are necessary, and the use of a mechanical device to make the injection is not indicated.

Additional measurements were made at the patient's back to determine the dose he received during the procedure, and it was found to be about 0.5 *r* per exposure, or 5.0 r per examination. This is in itself no great hazard, but it must be considered when other examinations, including fluoroscopy, are contemplated.

It is stressed that these findings are applicable only under the conditions described by the authors. In view of the variations in angiocardiographic technic, individual evaluation of the hazards involved must be made.

Five illustrations. JOHN R. OLSON, M.D.
Indiana University

Some Observations on the Relation Between Radiation Dose Measures and Blood Changes. Matts Helde and T. Wahlberg. Acta radiol. **40:** 435–442, October 1953.

The authors studied the relation between blood changes and radiation exposure in eleven groups of persons receiving whole-body irradiation. Four of the groups represented industrial installations, five dental, and two medical. The irradiation conditions varied from group to group but were uniform within each group. The tube voltage was between 50 and 100 kv.

The blood changes recorded were leukocyte count, shift to the left, relative lymphocytosis, and presence of pathologic lymphocytes or hypersegmented neutrophils.

The observations indicated (1) that the blood picture may be changed by very small amounts of radiation; (2) that it is a good indicator of irradiation if the latter is referred to a very low time unit; (3) that it is apparently independent of the irradiation dose per day, week, etc., when the doses are small.

From a practical point of view, as regards prevention of hazards, it is emphasized that it will frequently be easier to correlate the safety of the personnel to real dose rates than to doses which are to be received during long periods at various types, places, etc., of work. Similar observations in installations with well defined uniform irradiation conditions would contribute further to radiation hazard control.

Three diagrams. LAWRENCE A. DAVIS, M.D.
University of Louisville

Spontaneous Cholecystectomy. Report of a Case Probably Resulting from Irradiation of Hepatic Metastasis. Alexander Brunschwig. Arch. Surg. **67:** 620–622, October 1953.

The author presents an unusual case of spontaneous gangrene, sequestration, and extrusion of the gallbladder.

A 67-year-old man received a course of deep therapy to the porta hepatis for liver metastases from carcinoma of the stomach (the estimated tumor dose at 6 cm. was 2,700 r). About one month after completion of ir-

radiation the patient had a severe exacerbation of symptoms, for which resection of the left lobe of the liver was successfully performed. A certain measure of trauma was thus sustained by the irradiated area before the full effects of treatment were manifest. The gallbladder, normal at surgery, became progressively gangrenous due to vascular occlusion. An abscess developed, which drained through the operative wound. The then spontaneously sequestrated gallbladder extruded itself through a sinus in the wound, some two months after surgery. Subsequently the patient made an uneventful recovery.

One photograph; 1 drawing.

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Metastatic Frequency of Spontaneous Mammary Carcinoma in Mice Following Biopsy and Following Local Roentgen Irradiation. Sigvard Kaae. Cancer Res. **13**: 744–747, October 1953.

Local roentgen irradiation of spontaneous mammary carcinomas in DBA mice with doses of 1,000 to 2,000 r (180 kv., 3 mm. Al filter, h.v.l. 0.3 mm. Cu, focal-skin distance 40 cm.) was found to increase considerably the incidence of pulmonary metastases, as compared to a control group (22.2 per cent against 5.4 per cent). This increased incidence of pulmonary metastases was due only to a small extent to a longer survival, representing primarily a real increase in the metastatic tendency caused by the irradiation. Removal of biopsy specimens did not significantly increase the incidence of metastases (11.4 per cent, compared to 5.4 per cent in the control group).

Two charts; 5 tables.

Neoplasms in Rats Exposed to Single-Dose Total-Body X Radiation. John C. Finerty, Robert T. Binhammer, Martin Schneider, and A. W. B. Cunningham. J. Nat. Cancer Inst. **14**: 149–157, August 1953.

By using postirradiation parabiosis to protect female rats from the lethal effect of 700 r (air) total-body irradiation, the authors have initiated a study into the subsequent effect of this exposure on these animals. The surgical union lasted for thirty days or less, a female litter-mate was used, and the exposed individuals were placed in parabiosis within three hours following the irradiation. Eighty per cent of the animals survived for at least thirty days. They were then surgically separated.

Thirty-two pairs were observed for longer than six months. Nine of the 32 irradiated rats developed a total of 11 neoplasms. No malignant growths were observed in the non-irradiated partners.

The neoplasms observed consisted of rhabdomyosarcomata, adenocarcinomata, two pericanalicular fibroadenomata, and a meningioma. It was noteworthy that no lymphomata occurred. The authors plan further studies throughout the life span of these animals.

Eight photomicrographs; 9 diagrams.

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Neoplasms in Rats Protected Against Lethal Doses of Irradiation by Parabiosis or Para-Aminopropriophenone. G. Brecher, E. P. Cronkite, and James H. Peers. J. Nat. Cancer Inst. **14**: 159–175, August 1953.

Five groups of rats were exposed to total-body irradiation, in lethal doses, between 700 and 1,000 r (air). Para-aminopropriophenone and glutathione injected intraperitoneally and surgical parabiosis were used to protect some animals in each group from the lethal effect of the irradiation.

Animals which survived thirty days or more after the irradiation were studied. No tumors developed in rats surviving less than six months. Eight malignant tumors occurred in rats living more than six months. Of particular interest was the unusual type of tumor which developed in these animals. Six of the 8 tumors were of epithelial origin, and all were locally invasive. Three of these tumors metastasized.

The high incidence of tumor occurrence as well as the unusual type of tumor seen indicates that the neoplasms were induced by the irradiation.

Fifteen photomicrographs; 1 chart.

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Influence of Postirradiation Thymectomy and of Thymic Implants on Lymphoid Tumor Incidence in C57BL Mice. Henry S. Kaplan, Mary B. Brown, and Janice Paull. Cancer Res. **13**: 677–680, September 1953.

The authors studied the effect of thymectomy, at varying intervals after irradiation, on lymphoid tumor incidence in mice. They also sought to determine whether homologous thymic tissue implanted after irradiation can restore the lymphoma susceptibility of thymectomized mice.

In Experiment I, 8 groups of 16 mice each were treated with four total-body x-ray exposures of 168 r at intervals of eight days. One was kept intact and served as an irradiated control. The others were designated for thymectomy at four, six, eight, ten, twelve, and sixteen weeks, respectively, after the last irradiation; an additional group of irradiated "spares" was assigned to the six-week group when operative deaths in this group became excessive. Physical factors for the irradiation were: 120 kv.p., 9 ma., 0.25 mm. Cu plus 1.0 mm. Al added filter; 30 cm. mouse-target distance; 32 r per minute; h.v.l. 0.39 mm. Cu. Thymectomy as late as twelve weeks after irradiation completely suppressed subsequent lymphoid tumor development and effected apparent cures of 2 mice whose excised thymuses were shown by bioassay to contain tumor. Tumors were encountered sporadically in thymuses removed at six weeks, in about one-third of those removed at ten weeks, and in the majority of those removed twelve weeks after irradiation.

In Experiment II, 7 groups, each containing 50 to 60 mice, were employed. All but 1 of these received total-body irradiation in four doses of 168 r at four-day intervals. Physical factors were the same as in Experiment I. Four groups were thymectomized by the usual technic; the other 3 were subjected to a sham operation, in which the thorax was opened but the thymus was left intact. All operations were performed four days before irradiation was begun. Whole thymus glands were quickly excised from donor mice; some were then rapidly given a single x-ray dose of 990 r *in vitro*, after which one entire irradiated or non-irradiated thymus was implanted through a small cutaneous incision into the axillary subcutaneous tissue of each mouse of the recipient groups within one to two hours after the last total-body x-ray exposure. It was found that the thymectomized mice implanted, after irradiation, with

homologous thymic grafts, either intact or irradiated *in vitro*, had a significantly higher incidence of lymphoid tumors than litter-mates similarly treated but receiving no thymic implants. Incidence remained far below the levels of sham-operated, irradiated groups, and was lower for the irradiated than for the intact implants.

One photomicrograph.

Endocrine Changes After Hemiadrenalectomy and Total Body Irradiation in Parabiotic Rats. Sheldon C. Sommers. J. Lab. & Clin. Med. **42**: 396–407, September 1953.

In an earlier paper (J. Lab. & Clin. Med. **40**: 342, 1952. Abst. in Radiology **61**: 157, 1953) Edwards and Sommers described the radiation reactions in parabiotic rats, one in each pair of which was exposed to a single dose of 400, 800, 1,200, or 1,600 r total-body x-radiation. No evidence was obtained that any tissue damage produced in the one parabiotic partner by the irradiation was transmitted to its non-irradiated shielded partner by substances circulating and crossing the vascular anastomosis. Sommers now describes the results of a morphologic study of endocrine changes in the parabiotic rats during short intervals after irradiation.

Aside from those in the radiosensitive gonadal tissues, few endocrine gland changes were commonly observed, except after prior hemiadrenalectomy. In animals protected from irradiation, ovarian granulosa cells showed post-irradiation hyperplasia.

In relatively strained adrenal functional states, radiation produced a decrease of lipid and free carbonyl groups in the adrenal cortex. Increased incidences of hyperplasias of thymus, bone marrow leukocyte precursors, and testicular interstitial cells indicated that, under maximal experimental strain, irradiation had reduced adrenal cortical functions. Pancreatic islets, ovarian theca cells, and thyroid also more often became hyperplastic in post-irradiation hypoadrenal conditions. A considerable normal adrenal margin of safety was evident.

Pituitary cells showed slight direct radiation effects after 1,600 r. Anterior pituitary function seemed unaffected or stimulated following irradiation, as shown by tissue responses attributed to gonadotropin, adrenocorticotropin, growth hormone, and thyrotropin secretion. Cell counts indicated irregular post-irradiation hyperplasias of pituitary basophils and eosinophils.

Four illustrations; 3 tables.

Regeneration of the Anterior End of Aulophorus furcatus (Naididae) with Special Reference to Effect of X-Rays. Robert Hugh Foulkes. Biol. Bull. **105**: 80–86, August 1953.

A comparative study of regeneration of the head of *Aulophorus furcatus* (an asexual, aquatic naid 3 to 7 mm. long, with the ability to regenerate very rapidly) in non-irradiated, anteriorly irradiated, and totally irradiated worms is presented. The irradiation consisted of 2,600 r delivered at a rate of 300 r per minute (200 kv.). In non-irradiated worms regeneration was completed during the fifth day. A delay in the initiation of regeneration and rate of regeneration was observed in the worms in which the anterior half was exposed to lethal irradiation, which apparently exerted its effect by killing or severely inhibiting the neoblasts. Totally irradiated worms failed to regenerate a new head and died fourteen to twenty-one days after irradiation.

In the species studied, it was demonstrated that the neoblasts are capable of migrating both anteriorly and posteriorly. They apparently contribute, directly or indirectly, to the regeneration of both non-irradiated and irradiated specimens. The neoblast probably forms some of the new mesodermal tissues.

Six photomicrographs.

Investigations into the First Effects of Roentgen Rays on Living Protoplasm as Studied with Modern Fluorochromes. S. P. Strugger, A. T. Krebs, and Z. S. Gierlach. Am. J. Roentgenol. **70**: 365–375, September 1953.

The effects of roentgen rays on plant cells, immediately after and during irradiation, were studied with modern fluorochrome technics, photographically recorded, and analyzed by the authors. This method of detection of early and delayed radiation damage to protoplasm is a definite contribution to the field of radiology. It was found that under special experimental conditions (proper stain concentration, pH values, and staining times), differentiation between viable and nonviable tissue was possible. This was due to the "concentration effect" that the acridine orange fluorochrome especially exhibits. Living protoplasm takes up small amounts of the stain and shows a green fluorescence, while damaged protoplasm takes up larger amounts and shows an orange to red fluorescence, dependent upon the degree of destruction. A color change of this nature holds true for heat, chemical, and mechanical damage.

The authors' methods permitted observation of very early roentgen effects, since the necessary doses could be applied in one to three minutes. *Allium cepa* epidermis irradiated with adequate doses of roentgen rays to produce damage (120,000–800,000 r) and then immediately stained, showed the initial effects to be in the form of damaged areas ("spots") along the longitudinal cell walls. Investigation utilizing auramine and neutral red, the bright-field microscope, dark-field equipment, and phase contrast apparatus, as well as plasmolysis experiments, revealed these spot effects as partial destruction of smaller or larger cytoplasmic areas. Irradiated sections stained at different time intervals after the irradiation showed a spreading of the damage, demonstrating that delayed effects could also be detected.

The work of other men in this field is mentioned and the authors describe in great detail their own technic. The many excellent photomicrographs in black and white and in color and the tables are a valuable addition to the paper.

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